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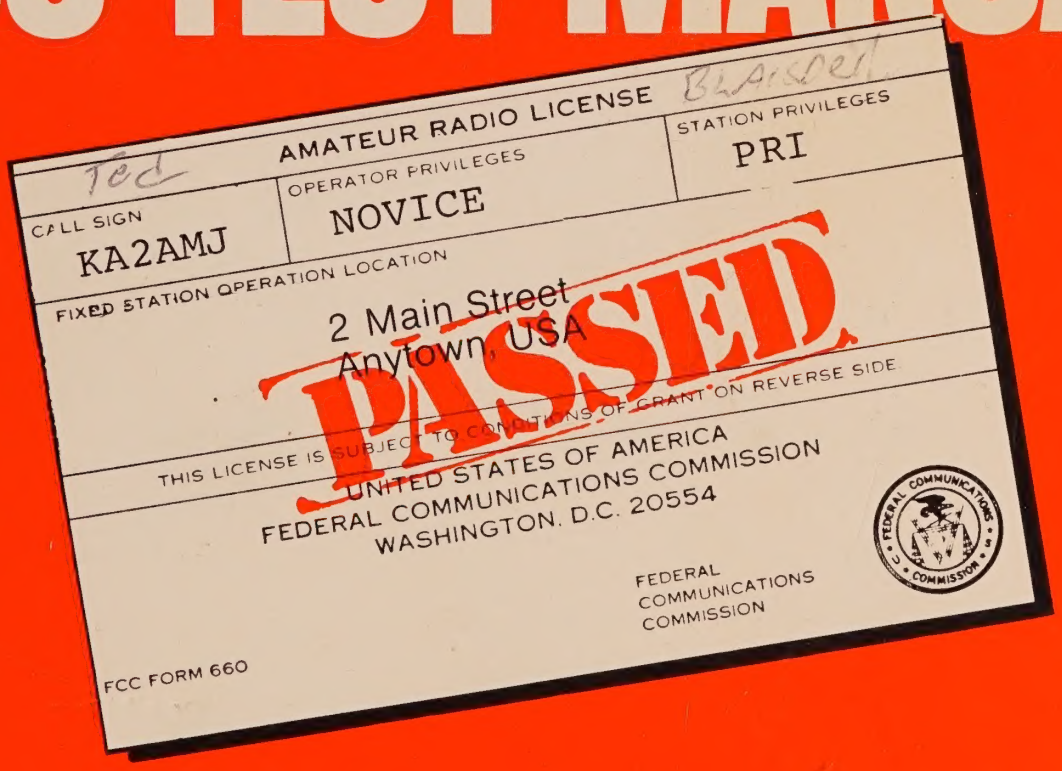

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NOVICE CLASS RADIO AMATEUR FCC TEST MANUAL

by

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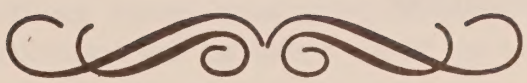

Published by
AMECO PUBLISHING CORP.
220 E. JERICHO TURNPIKE
MINEOLA, NEW YORK 11501

NOVICE CLASS
RADIO AMATEUR
FCC TEST MANUAL

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by the
Ameco Publishing Corp.

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Library of Congress Catalog. No 89-81078

ISBN No. 0-912146-21-4

Printed in the United States of America

PREFACE

This Novice Class FCC Test Manual is part of a series of books published by the Ameco Publishing Corp. for the purpose of preparing individuals for the Federal Communications Commission Amateur Radio Operator examinations.

The questions and multiple choice answers in this manual have been issued by the Volunteer Examiner Coordinator's Committee under the supervision of the FCC. The 30 questions and multiple choice answers on the actual examination will be drawn from these questions. The questions in this book are divided into subelements. A specific number of questions (shown under each subelement heading), will be taken from each subelement.

In those instances where this author feels that the correct multiple choice answer is complete and adequate for the proper understanding of the subject matter, there is no discussion; only the correct answer is indicated. In most of the questions, the discussions explain the correct multiple choice answers and give additional useful material that helps with the understanding of the questions and answers.

On September 1, 1989, the Federal Communications Commission changed some of the Rules and Regulations of Part 97. These changes have been incorporated into this manual. However, the Novice examinations that are given prior to July 1, 1990 will not include questions that have been affected by the new rules. After July 1, 1990 the Novice tests may include the new questions. Regardless of when the test is taken, the prospective amateur operator can study this manual without being concerned about the recent changes. All questions on the examination will be taken, word for word, from this manual.

The FCC examination for the Novice Class license consists of 30 questions. The minimum passing score is 22 questions answered correctly.

In order to simplify the work of the examiners, the Ameco Publishing Corp. publishes the actual Novice Class tests. Each test consists of 30 questions, randomly selected from the questions in this book, and is enclosed in a sealed envelope. The answers are furnished along with each test. A copy of FCC form 610 is also included. These test kits (Cat. #EN-1) may be obtained from the Ameco Publishing Corp. or from the various Radio Amateur dealers throughout the United States.

Although this guide deals with Element 2 of the Amateur Radio Operator's examinations, the Ameco Publishing Corp. publishes guides covering all the other amateur elements, as well as code courses for learning the International Morse Code. If additional theory background information is required, it is suggested that the Novice Class Theory Course (Cat. #23-01) or the Amateur Radio Theory Course (Cat. #102-01) be consulted. See back cover for details. GOOD LUCK!

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SUBELEMENT 2A
Commission's Rules
(10 Questions)

One question must be from the following:

2A-1.1 What are the five principles that express the fundamental purpose for which the amateur service rules are designed?

A. Recognition of emergency communications, advancement of the radio art, improvement of communication and technical skills, increase in the number of trained radio operators and electronics experts, and the enhancement of international goodwill

B. Recognition of business communications, advancement of the radio art, improvement of communication and business skills, increase in the number of trained radio operators and electronics experts, and the enhancement of international goodwill

C. Recognition of emergency communications, preservation of the earliest radio techniques, improvement of communication and technical skills, maintain a pool of people familiar with early tube-type equipment, and the enhancement of international goodwill

D. Recognition of emergency communications, advancement of the radio art, improvement of communication and technical skills, increase in the number of trained radio operators and electronic experts, and the enhancement of a sense of patriotism

The answer is A. The five principles are:

(a) Recognition and enhancement of the value of the amateur service to the public as a voluntary, noncommercial, communication service, particularly with respect to providing emergency communications.

(b) Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c) Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communication and technical phases of the art.

(d) Expansion of the existing reservoir within the amateur service of trained operators, technicians and electronics experts.

(e) Continuation and extension of the amateur's unique ability to enhance international good will.

2A-1.2 Which of the following is <u>not</u> one of the basic principles for which the amateur service rules are designed?

A. Providing emergency communications

B. Improvement of communication and technical skills

C. Advancement of the radio art
D. Enhancement of a sense of patriotism and nationalism
The answer is D. See answer 2A-1.1.

2A-1.3 The amateur service rules were designed to provide a radio communications service that meets five fundamental purposes. Which of the following is not one of those principles?
A. Improvement of communication and technical skills
B. Enhancement of international goodwill
C. Increase the number of trained radio operators and electronics experts
D. Preserving the history of radio communications
The answer is D. See answer 2A-1.1.

2A-1.4 The amateur service rules were designed to provide a radio communications service that meets five fundamental purposes. What are those principles?
A. Recognition of business communications, advancement of the radio art, improvement of communication and business skills, increase in the number of trained radio operators and electronics experts, and the enhancement of international goodwill
B. Recognition of emergency communications, advancement of the radio art, improvement of communication and technical skills, increase in the number of trained radio operators and electronics experts, and the enhancement of international goodwill
C. Recognition of emergency communications, preservation of the earliest radio techniques, improvement of communication and technical skills, maintain a pool of people familiar with early tube-type equipment, and the enhancement of international goodwill
D. Recognition of emergency communications, advancement of the radio art, improvement of communication and technical skills, increase in the number of trained radio operators and electronic experts, and the enhancement of a sense of patriotism
The answer is B. See answer 2A-1.1.

2A-2.1 What is the definition of the amateur service?
A. A private radio service used for personal gain and public benefit
B. A public radio service used for public service communications
C. A radio communication service for the purpose of self-training, intercommunication and technical investigations
D. A private radio service intended for the furtherance of commercial radio interests
The answer is C. The complete definition of the amateur service is, "A radio communication service for the purpose of self-training, intercommunication and technical investigations carried out by amateurs, that is, duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest."

2A-2.2 What name is given to the radio communication service that is designed for self-training, intercommunication, and technical investigation?

A. The amateur service
B. The Citizen's Radio Service
C. The Experimenter's Radio Service
D. The Maritime Radio Service

The answer is A. See answer 2A-2.1.

2A-3.1 What document contains the specific rules and regulations governing the amateur service in the United States?

A. Part 97 of title 47 CFR (Code of Federal Regulations)
B. The communications act of 1934 (as amended)
C. The Radio Amateur's Handbook
D. The minutes of the International Telecommunication Union meetings

The answer is A. Part 97 was completely rewritten and a new version went into effect on September 1, 1989. According to the FCC, "The amateur service rules were restructured to provide a more meaningful, easy-to-use body of regulations. Unnecessary, obsolete, and redundant rule provisions were deleted. The emission designators were simplified into a simple system based upon nine terms that are already familiar to amateur operators, such as phone, RTTY, and CW."

2A-3.2 Which one of the following topics is NOT addressed in the rules and regulations of the amateur service?

A. Station operation standards
B. Technical standards
C. Providing emergency communications
D. Station construction standards

The answer is D. The six Subparts of Part 97 are: A-General Provisions, B-Station Operation Standards, C-Special Operations, D-Technical Standards, E-Providing Emergency Communications and F-Qualifying Examination Systems.

2A-4.1 What is the definition of an amateur operator?

A. A person who has not received any training in radio operations
B. A person holding a written authorization to be the control operator of an amateur station STATION LICENSE
C. A person who performs private radio communications for hire
D. A trainee in a commercial radio station

The answer is B. An amateur operator is a person holding a valid license, issued by the Federal Communications Commission (FCC), to operate an amateur station.

2A-4.2 What term describes a person holding a written authorization to be the control operator of an amateur station?

A. A Citizen Radio operator
B. A Personal Radio operator
C. A Radio Service operator
D. An amateur operator

The answer is D. See answer 2A-4.1.

One question must be from the following:

2A-5.1 What is the portion of an amateur operator/primary station license that conveys operator privileges?

A. The verification section
B. Form 610
C. The operator license
D. The station license

The answer is C.

2A-5.2 What authority is derived from an operator/primary station-license?

A. The authority to operate any shortwave radio station
B. The authority to be the control operator of an amateur station
C. The authority to have an amateur station at a particular location
D. The authority to transmit on either amateur or Class D citizen's band frequencies

The answer is B. The operator/primary station license is the instrument of authorization, including the class of operator privileges. See answer 2A-6.1.

2A-6.1 What authority is derived from a written authorization for an amateur station?

A. The authority to use specified operating frequencies
B. The authority to operate an amateur station
C. The authority to enforce FCC Rules when violations are noted on the part of other operators
D. The authority to transmit on either amateur or Class D citizen's band frequencies

The answer is B. An operator/primary station license (FCC Form 660) is issued only to a person. It contains the primary station license and the operator license on the same document.

2A-6.2 What part of your amateur license gives you authority to operate an amateur station?

A. The operator license
B. The FCC Form 610
C. The station license
D. An amateur license does not specify a station location

The answer is C. The station license is the instrument of authorization for a radio station in the amateur service. See answer 2A-6.1.

2A-7.1 What is an amateur station?

A. A licensed radio station engaged in broadcasting to the public in a limited and well-defined area
B. A radio station used to further commercial radio interests

C. A private radio service used for personal gain and public service
D. A station in an amateur service consisting of the apparatus necessary for carrying on radio communications

The answer is D.

2A-8.1 Who is a control operator?

A. An amateur operator designated by the licensee of a station to be responsible for the transmissions from that station to assure compliance with the FCC rules
B. A person, either licensed or not, who controls the emissions of an amateur station
C. An unlicensed person who is speaking over an amateur station's microphone while a licensed person is present
D. A government official who comes to an amateur station to take control for test purposes

The answer is A. The control operator may also be the licensee of the station.

2A-8.2 If you designate another amateur operator to be responsible for the transmissions from your station, what is the other operator called?

A. Auxiliary operator
B. Operations coordinator
C. Third party
D. Control operator

The answer is D. See question 2A-8.1.

2A-9.1 List the five United States amateur license classes in order of increasing privileges.

A. Novice, General, Technician, Advanced, Amateur Extra
B. Novice, Technician, General, Advanced, Digital
C. Novice, Technician, General, Amateur, Extra
D. Novice, Technician, General, Advanced, Amateur Extra

The answer is D.

2A-9.2 Which US amateur operator license is considered to be the "entry level" or "beginner's" license?

A. The Novice class license
B. The CB license
C. The Technician class license
D. The Amateur class License

The answer is A.

2A-9.3 What is the license class immediately above Novice class?

A. The Digital class license
B. The Technician class license
C. The General class license
D. The Experimenter's class license

The answer is B. The written test for the Technician Class license is more difficult than the one for the Novice Class license. However, the code speed requirement for both is 5 words per minute.

One question must be from the following:

2A-10.1 What frequencies are available in the amateur 80-meter wavelength band for a control operator holding a Novice class operator license?

A. 3500 to 4000 kHz
B. 3700 to 3750 kHz
C. 7100 to 7150 kHz
D. 7000 to 7300 kHz

The answer is B. He may transmit a CW emission, using the international Morse Code, between 3,700 and 3,750 kHz. See the chart on page AP-4.

2A-10.2 What frequencies are available in the amateur 40-meter wavelength band for a control operator holding a Novice class operator license in ITU region 2?

A. 3500 to 4000 kHz
B. 3700 to 3750 kHz
C. 7100 to 7150 kHz
D. 7000 to 7300 kHz

The answer is C. He may transmit a CW emission, using the international Morse Code, between 7,100 kHz and 7,150 kHz (7050-7075 kHz when the terrestrial station location is NOT within Region 2). Region 2 includes North and South America.

2A-10.3 What frequencies are available in the amateur 15-meter wavelength band for a control operator holding a Novice class operator license?

A. 21.100 to 21.200 MHz
B. 21.000 to 21.450 MHz
C. 28.000 to 29.700 MHz
D. 28.100 to 28.200 MHz

The answer is A. He may transmit a CW emission, using the international Morse Code, between 21,100 kHz and 21,200 kHz.

2A-10.4 What frequencies are available in the amateur 10-meter wavelength band for a control operator holding a Novice class operator license?

A. 28.000 to 29.700 MHz
B. 28.100 to 28.300 MHz
C. 28.100 to 28.500 MHz
D. 28.300 to 28.500 MHz

The answer is C. The Novice control operator frequency privileges in the 10 meter wavelength band were increased on March 21, 1987. Prior to that time, he was only permitted to operate CW from 28.1 to 28.2 MHz. Now, he can operate CW from 28.1 to 28.5 MHz. He can also transmit data or RTTY from 28.1 to 28.3 MHz and sideband telephony from 28.3 to 28.5 MHz.

2A-10.5 What frequencies are available in the amateur 220-MHz band for a control operator holding a Novice class operator license in ITU region 2?

A. 225.0 to 230.5 MHz
B. 222.1 to 223.91 MHz
C. 224.1 to 225.1 MHz
D. 222.2 to 224.0 MHz

The answer is B. 222.1 to 223.91 MHz is the Novice sub-band in the 1.25 meter wavelength band. The entire band is from 220 to 225 MHz. Novices can use all amateur modes and emissions in their sub-band.

2A-10.6 What frequencies are available in the amateur 1270-MHz band for a control operator holding a Novice class operator license?
A. 1260 to 1270 MHz B. 1240 to 1300 MHz
C. 1270 to 1295 MHz D. 1240 to 1246 MHz
The answer is C. 1270 to 1295 MHz is the Novice sub-band in the 0.23 meter wavelength band. The entire band is from 1240 to 1300 MHz. Novices can use all amateur modes and emissions in their sub-band.

2A-10.7 If you are operating your amateur station on 3725 kHz, in what meter wavelength band are you operating?
A. 80 meters B. 40 meters C. 15 meters D. 10 meters
The answer is A. The entire 80 meter wavelength band is from 3,500 to 4,000 kHz. The Novice sub-band is from 3700 to 3750 kHz. See the chart on Page AP-4.

2A-10.8 If you are operating your amateur station on 7125 kHz, in what meter wavelength band are you operating?
A. 80 meters B. 40 meters C. 15 meters D. 10 meters
The answer is B. The entire 40 meter wavelength band is from 7,000 kHz to 7,300 kHz. The Novice sub-band is from 7100 to 7150 kHz. See the chart on page AP-4.

2A-10.9 If you are operating your amateur station on 21150 kHz, in what meter wavelength band are you operating?
A. 80 meters B. 40 meters C. 15 meters D. 10 meters
The answer is C. The entire 15 meter wavelength band extends from 21,000 to 21,450 kHz. The Novice part of the band is from 21,100 to 21,200 kHz. 21,150 kHz is therefore in the Novice part of the 15 meter wavelength band.

2A-10.10 If you are operating your amateur station on 28150 kHz, in what meter wavelength band are you operating?
A. 80 meters B. 40 meters C. 15 meters D. 10 meters
The answer is D. The entire 10 meter wavelength band extends from 28,000 to 29,700 kHz. The Novice part of the band is from 28,100 to 28,500 kHz. 28,150 is therefore in the Novice part of the 10 meter wavelength band.

One question must be from the following:

2A-11.1 Who is eligible to obtain a US amateur operator/primary station license?
A. Anyone except a representative of a foreign government
B. Only a citizen of the United States
C. Anyone
D. Anyone except an employee of the United States Government
The answer is A. An ordinary citizen of a foreign country IS eligible to

obtain a U.S. amateur operator/primary station license.

2A-11.2 Who is not eligible to obtain a US amateur operator/primary station license?

A. Any citizen of a country other than the United States
B. A representative of a foreign government
C. No one
D. An employee of the United States Government

The answer is B. See question 2A-11.1.

2A-12.1 What FCC examination elements are required for a Novice class license?

A. Elements 1(A) and 2(A)
B. Elements 1(A) and 3A
C. Elements 1(A) and 2
D. Elements 2 and 4

The answer is C. Element 1(A) is a 5 word per minute code test and element 2 is a basic written examination.

2A-12.2 What is an FCC Element 1(A) examination intended to prove?

A. The applicant's ability to send and receive texts in the international Morse code at not less than 5 words per minute
B. The applicant's ability to send and receive texts in the international Morse code at not less than 13 words per minute
C. The applicant's knowledge of Novice class theory and regulations
D. The applicant's ability to recognize Novice frequency assignments and operating modes

The answer is A. The structure of the code test can vary, depending upon the examiner's choice. An examiner may send 5 minutes of plain text and expect the applicant to copy at least one minute of the text 100% correct. The examiner may also send 5 minutes of plain text and expect the applicant to answer correctly at least 7 out of 10 questions based on the copied text.

2A-12.3 What is an FCC Element 2 examination?

A. A test of the applicant's ability to send and receive Morse code at 5 words per minute
B. The written examination concerning the privileges of a Technician class operator license
C. A test of the applicant's ability to recognize Novice frequency assignments
D. The written examination concerning the privileges of a Novice class operator license

The answer is D. The element 2 test consists of 30 questions taken from a pool of published questions. The applicant must answer 22 questions correctly.

2A-13.1 Who is eligible to obtain an FCC-issued written authorization for an amateur station?

A. A licensed amateur operator
B. Any unlicensed person, except an agent of a foreign government
C. Any unlicensed person, except an employee of the United States Government
D. Any unlicensed United States Citizen
The answer is A.

2A-14.1 Why is an amateur operator required to furnish the FCC with a current mailing address served by the US Postal service?
A. So the FCC has a record of the location of each amateur station
B. In order to comply with the Commission's rules and so the FCC can correspond with the licensee
C. So the FCC can send license-renewal notices
D. So the FCC can compile a list for use in a call sign directory
The answer is B.

2A-15.1 Which one of the following call signs is a valid US amateur call?
A. UA4HAK B. KBL7766 C. KA9OLS D. BY7HY
The answer is C. U.S. amateurs may only use call signs beginning with the letters K, N, W or A. Thus, answers A and D are eliminated. The structure of a U.S. call sign consists of one or two letters, a number from 0 to 9, followed by one to three letters. Thus, B is eliminated. Answer C (KA9OLS) is known as a 2 x 3 call. It consists of two letters, a number and then three letters. The 2 x 3 format call signs are issued to Novice operators.

2A-15.2 Which one of the following call signs is a valid US amateur call?
A. CE2FTF B. G3GVA C. UA1ZAM D. AA2Z
The answer is D. See answer 2A-15.1. Answers A, B and C are eliminated because they start with the wrong letter. Answer D uses a 2 x 1 format, which is the type given to Extra Class licensees.

2A-15.3 Which one of the following call signs is <u>not</u> a valid US amateur call?
A. KDV5653 B. WA1DVU C. KA5BUG D. NT0Z
The answer is A. See answer 2A-15.1. Answer A is not a valid U.S. call sign because it contains a prefix of three letters followed by a four digit number.

2A-15.4 What letters may be used for the first letter in a valid US amateur call sign?
A. K, N, U and W B. A, K, N and W
C. A, B, C and D D. A, N, V and W
The answer is B. See answer 2A-15.1.

2A-15.5 Excluding special-event call signs that may be issued by the

FCC, what numbers may be used in a valid US call sign?
A. Any double-digit number, 10 through 99
B. Any double-digit number, 22 through 45
C. Any single digit, 1 though 9
D. A single digit, 0 through 9

The answer is D. The digit, which is the second part of the call sign, is a single number from 0 through 9. It indicates the geographical district where the station is located. For instance, in the Continental United States, a 2 indicates New York and New Jersey; a 6 indicates California, a 9 indicates Illinois, Indiana and Wisconsin, etc.

The digits for the various locations are shown in the chart below:

DIGIT	LOCATION
1	Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut
2	New York, New Jersey, Guam
3	Pennsylvania, Delaware, Maryland, District of Columbia
4	Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Kentucky, Puerto Rico
5	Mississippi, Louisiana, Arkansas, Oklahoma, Texas, New Mexico
6	California, Hawaii
7	Oregon, Washington, Idaho, Montana, Wyoming, Arizona, Nevada, Utah, Alaska
8	Michigan, Ohio, West Virginia
9	Illinois, Indiana, Wisconsin
0	Colorado, Nebraska, North Dakota, South Dakota, Minnesota, Iowa, Missouri, Kansas

2A-16.1 Your Novice license was issued on November 1, 1988. When will it expire?
A. On the date specified on the license
B. November 30, 1998
C. November 1, 1993
D. November 1, 1990

The answer is A. Amateur operator/primary station licenses are normally valid for a period of ten years from the date of issuance of a new, modified or renewed license. There is a two year grace period allowed for the reinstatement of expired licenses.

One question must be from the following:

2A-17.1 What does the term emission mean?
A. RF signals transmitted from a radio station
B. Signals refracted by the E layer
C. Filter out the carrier of a received signal

D. Baud rate

The answer is A. Emission means the radio frequency energy coming from the radio station. There are different types of emissions that are permitted to amateur operators. See Appendixes 1 and 2 for a list of the various types of emissions that are used.

2A-17.2 What emission types are Novice control operators permitted to use on the 80-meter wavelength band?

A. CW only B. Data only C. RTTY only D. Phone only

The answer is A. CW is the term for International Morse code telegraphy emissions. See Appendixes 1 and 2.

2A-17.3 What emission types are Novice control operators permitted to use in the 40-meter wavelength band?

A. CW only B. Data only C. RTTY only D. Phone only

The answer is A. See answer 2A-17.2.

2A-17.4 What emission types are Novice control operators permitted to use in the 15-meter wavelength band?

A. CW only B. Data only C. RTTY only D. Phone only

The answer is A. See answer 2A-17.2.

2A-17.5 What emission types are Novice control operators permitted to use from 3700 to 3750 kHz?

A. Phone only
B. CW and phone
C. All amateur emission privileges authorized for use on those frequencies
D. CW only

The answer is D. See answer 2A-17.2. 3700 to 3750 kHz is the Novice part of the 80 meter wavelength band.

2A-17.6 What emission types are Novice control operators permitted to use from 7100 to 7150 kHz in ITU region 2?

A. CW and Data
B. Phone
C. All amateur emission privileges authorized for use on those frequencies
D. CW only

The answer is D. See answer 2A-17.3. 7100 to 7150 kHz is the Novice part of the 40 meter wavelength band.

2A-17.7 What emission types are Novice control operators permitted to use on frequencies from 21.1 to 21.2 MHz?

A. CW and data only
B. CW and phone only
C. All amateur emission privileges authorized for use on those frequen-

cies
D. CW only

The answer is D. See answer 2A-17.4. 21.1 to 21.2 MHz is the Novice part of the 15 meter wavelength band.

2A-17.8 What emission types are Novice control operators permitted to use on frequencies from 28.1 to 28.3 MHz?
A. All authorized amateur emission privileges
B. Data or phone only
C. CW, RTTY and data
D. CW and phone only

The answer is C. On March 21, 1987, Novices were granted permission to use CW and RTTY on frequencies between 28.1 and 28.3 MHz. Prior to that time, Novice operators were only permitted to use CW between 28.1 and 28.2 MHz.

2A-17.9 What emission types are Novice control operators permitted to use on frequencies from 28.3 to 28.5 MHz?
A. All authorized emission privileges
B. CW and data only
C. CW and single-sideband phone only
D. Data and phone only

The answer is C. On March 21, 1987, Novices were granted permission to use CW and single-sideband phone on frequencies between 28.3 and 28.5 MHz. See answer 2A-17.8.

2A-17.10 What emission types are Novice control operators permitted to use on the amateur 220-MHz band in ITU Region 2?
A. CW and phone only
B. CW and data only
C. Data and phone only
D. All amateur emission privileges authorized for use on 220 MHz

The answer is D. Effective March 21, 1987, Novices were permitted all authorized emission modes from 222.1 to 223.91 MHz. This includes CW, phone, data, RTTY, etc.

2A-17.11 What emission types are Novice control operators permitted to use on the amateur 1270-MHz band?
A. Data and phone only
B. CW and data only
C. CW and phone only
D. All amateur emission privileges authorized for use on 1270 MHz

The answer is D. Effective March 21, 1987, Novices were permitted all authorized emission modes on 1270 to 1295 MHz. This includes CW, phone, data, RTTY, etc.

2A-17.12 On what frequencies in the 10 meter wavelength band may

a Novice control operator use single sideband phone?

A. 3700 to 3750 kHz
B. 7100 to 7150 kHz
C. 21100 to 21200 kHz
D. 28300 to 28500 kHz

The answer is D. Novices may operate CW or single sideband (not amplitude modulation) in the 28.3 to 28.5 MHz part of the 10 meter wavelength band. See answers 2A-17.8 and 2A-17.9.

2A-17.13 On what frequencies in the 1.25 meter wavelength band in ITU Region 2 may a Novice control operator use FM phone emission?

A. 28.3 to 28.5 MHz
B. 144.0 to 148.0 MHz
C. 222.1 to 223.91 MHz
D. 1240 to 1270 MHz

The answer is C. FM voice (phone) is permitted in the 220 - 225 MHz band. Novices are entitled to all amateur emission privileges in their part (222.1 - 223.91 MHz) of the band.

One question must be from the following:

2A-18.1 What amount of output transmitting power may a Novice class control operator use when operating below 30 MHz?

A. 200 watts input
B. 250 watts output
C. 1500 watts PEP output
D. The minimum legal power necessary to carry out the desired communications

The answer is D. Operating with more power than is necessary to carry out the desired communications will cause unnecessary interference to other communications.

2A-18.2 What is the maximum transmitting power ever permitted to be used by an amateur station transmitting in the 80, 40 and 15-meter wavelength Novice bands?

A. 75 watts PEP output
B. 100 watts PEP output
C. 200 watts PEP output
D. 1500 watts PEP output

The answer is C. The maximum transmitting power (peak envelope power output), permitted to ALL amateurs in the 80, 40 and 15 meter wavelength Novice sub-bands, is 200 watts. Novice and Technician operators are permitted a maximum of 200 watts PEP output in the 10 meter wavelength Novice sub-band. Other amateur operators are permitted full power in the 10 meter wavelength Novice sub-band. Novice operators are permitted a maximum of 25 watts in the 1.25 meter wavelength Novice sub-band, and 5 watts in the 0.23 meter wavelength Novice sub-band. All other amateur operators may use full power in the 1.25 meter and 0.23 meter wavelength Novice sub-bands.

2A-18.3 What is the maximum transmitting power permitted an amateur station transmitting on 3725 kHz?

A. 75 watts PEP output B. 100 watts PEP output
C. 200 watts PEP output D. 1500 watts PEP output

The answer is C. 3725 kHz is a frequency in the 80 meter wavelength Novice sub-band. Therefore, the transmitting power (peak envelope power output) of all amateurs must never exceed 200 watts in this sub-band. See answer 2A-18.2.

2A-18.4 What is the maximum transmitting power permitted an amateur station transmitting on 7125 kHz?

A. 75 watts PEP output B. 100 watts PEP output
C. 200 watts PEP output D. 1500 watts PEP output

The answer is C. 7125 kHz is a frequency in the 40 meter wavelength Novice sub-band. Therefore, the transmitting power (peak envelope power output) of all amateurs must never exceed 200 watts in this sub-band. See answer 2A-18.2.

2A-18.5 What is the maximum transmitting power permitted an amateur station transmitting on 21.125 MHz?

A. 75 watts PEP output B. 100 watts PEP output
C. 200 watts PEP output D. 1500 watts PEP output

The answer is C. 21.125 MHz is in the Novice portion of the 15 meter wavelength band. All amateurs operating in the 80, 40, and 15 meter wavelength Novice sub-bands are limited to 200 watts PEP output.

2A-19.1 What is the maximum transmitting power permitted an amateur station with a Novice control operator transmitting on 28.125 MHz?

A. 75 watts PEP output B. 100 watts PEP output
C. 200 watts PEP output D. 1500 watts PEP output

The answer is C. The 200 watt PEP output limit in this portion of the 10 meter wavelength band applies only to Novice and Technician Class operators.

2A-19.2 What is the maximum transmitting power permitted an amateur station with a Novice control operator transmitting in the amateur 10-meter wavelength band?

A. 25 watts PEP output B. 200 watts PEP output
C. 1000 watts PEP output D. 1500 watts PEP output

The answer is B. The rule change of March 21, 1987 that expanded the Novice part of the 10 meter wavelength sub-band from 28.1-28.2 MHz to 28.1-28.5 MHz did not change the amount of power that a Novice could use in this sub-band. It was and is 200 watts PEP.

2A-19.3 What is the maximum transmitting power permitted an amateur station with a Novice control operator transmitting in the amateur 220-MHz band?

A. 5 watts PEP output B. 10 watts PEP output

C. 25 watts PEP output D. 200 watts PEP output

The answer is C. Amateur operators, other than Novices, are permitted 1500 watts PEP output in the 220-MHz band. However, Novices are only permitted 25 watts PEP output in their sub-band.

2A-19.4 What is the maximum transmitting power permitted an amateur station with a Novice control operator transmitting in the amateur 1270-MHz band?

A. 5 milliwatts PEP output B. 500 milliwatts PEP output
C. 1 watt PEP output D. 5 watts PEP output

The answer is D. Amateur operators, other than Novices, are permitted 1500 watts PEP output in the 1270-MHz band. However, Novices are only permitted 5 watts PEP output in their sub-band.

2A-19.5 What amount of transmitting power may an amateur station with a Novice control operator use in the amateur 220-MHz band?

A. Not less than 5 watts PEP output
B. The minimum legal power necessary to maintain reliable communications
C. Not more than 50 watts PEP output
D. Not more than 200 watts PEP output

The answer is B. Using the minimum legal power necessary to maintain reliable communications is the rule on all bands and with all classes of amateur operators.

2A-20.1 What term is used to describe narrow-band direct-printing telegraphy emissions?

A. Teleport communications B. Direct communications
C. RTTY communications D. Third-party communications

The answer is C. See Appendixes 1 and 2.

2A-20.2 What term is used to describe telemetry, telecommand and computer communications emissions?

A. Teleport communications B. Direct communications
C. Data communications D. Third-party communications

The answer is C. Amateur operators use computers to encode and decode digital signals and communicate with each other in this manner.

2A-20.3 On what frequencies in the 10-meter wavelength band are Novice control operators permitted to transmit RTTY?

A. 28.1 to 28.5 MHz B. 28.0 to 29.7 MHz
C. 28.1 to 28.2 MHz D. 28.1 to 28.3 MHz

The answer is D. See answer 2A-17.8.

One question must be from the following:

2A-21.1 Who is held responsible for the proper operation of an amateur station?

A. Only the control operator
B. Only the station licensee
C. Both the control operator and the station licensee
D. The person who owns the property where the station is located
The answer is C.

2A-21.2 You allow another amateur operator to use your amateur station. What are your responsibilities, as the station licensee?
A. You and the other amateur operator are equally responsible for the proper operation of your station
B. Only the control operator is responsible for the proper operation of the station
C. As the station licensee, you must be at the control point of your station whenever it is operated
D. You must notify the FCC when another amateur will be the control operator of your station
The answer is A.

2A-21.3 What is your primary responsibility as the station licensee?
A. You must permit any licensed amateur operator to operate your station at any time upon request
B. You must be present whenever the station is operated
C. You must notify the FCC in writing whenever another amateur operator will act as the control operator
D. You are responsible for the proper operation of the station for which you are licensed
The answer is D. See question 2A-21.2.

2A-21.4 If you are the licensee of an amateur station, when are you <u>not</u> responsible for its proper operation?
A. Only when another licensed amateur is the control operator
B. The licensee is responsible for the proper operation of the station for which he or she is licensed
C. Only after notifying the FCC in writing that another licensed amateur will assume responsibility for the proper operation of your station
D. Only when your station is in repeater operation
The answer is B. See question 2A-21.2.

2A-22.1 When must an amateur station have a control operator?
A. A control operator is only required for training purposes
B. Whenever the station receiver is operated
C. Whenever the station is transmitting
D. A control operator is not required
The answer is C. Every amateur station, when transmitting, must have a control operator at an authorized control point. The control operator must be on duty, except when the station is operated under automatic control.

2A-22.2 Another amateur gives you permission to use her amateur station. What are your responsibilities, as the control operator?

A. Both you and she are equally responsible for the proper operation of her station
B. Only the station licensee is responsible for the proper operation of the station, not you the control operator
C. You must be certain the station licensee has given proper FCC notice that you will be the control operator
D. You must inspect all antennas and related equipment to ensure they are working properly

The answer is A.

2A-23.1 Who may be the control operator of an amateur station?

A. Any person over 21 years of age
B. Any properly licensed amateur operator that is designated by the station licensee
C. Any licensed amateur operator with an Advanced class license or higher
D. Any person over 21 years of age with a General class license or higher

The answer is B. The control operator may be the station licensee, if he is a licensed amateur operator, or he may be another amateur operator with the required class of license and designated by the station licensee.

2A-24.1 Where must an amateur operator be when he or she is performing the duties of control operator?

A. Anywhere in the same building as the transmitter
B. At the control point of the amateur station
C. At the station entrance, to control entry to the room
D. Within sight of the station monitor, to view the output spectrum of the transmitter

The answer is B. See question 2A-22.1.

2A-25.1 Where must you keep your amateur operator license when you are operating a station?

A. Your original operator license must always be posted in plain view
B. Your original operator license must always be taped to the inside front cover of your station log
C. You must have the original or a photocopy of your operator license in your possession
D. You must have the original or a photocopy of your operator license posted at your primary station location. You need not have the original license nor a copy in your possession to operate another station

The answer is C. See answer 2A-26.1.

2A-26.1 Where must you keep your written authorization for an amateur station?

A. Your original station license must always be taped to the inside front cover of your station log
B. Your original station license must always be posted in plain view
C. You must post the original or a photocopy of your station license at the main entrance to the transmitter building
D. The original or a photocopy of the written authorization for an amateur station must be retained at the station

The answer is D. The original license of each amateur station, or a photocopy thereof, shall be posted in a conspicuous place in the room occupied by the licensed operator while the station is being operated at a fixed location, or shall be kept in his or her personal possession. When the station is operated at other than a fixed location, the original station license, or a photocopy thereof, shall be kept in the personal possession of the station licensee (or a licensed representative), who shall be present at the station while it is being operated as a portable or mobile station.

One question must be from the following:

2A-27.1 How often must an amateur station be identified?

A. At the beginning of the contact and at least every ten minutes during a contact
B. At least once during each transmission
C. At least every ten minutes during a contact and at the end of the contact
D. Every 15 minutes during a contact and at the end of the contact

The answer is C. An amateur station shall be identified by the transmission of its call sign at the end of each communication, and every 10 minutes or less during a communication. The word "communication" is understood to mean a completed conversation. During a single communication, two amateurs can switch back and forth many times.

2A-27.2 As an amateur operator, how should you correctly identify your station?

A. With the name and location of the control operator
B. With the station call sign
C. With the call of the control operator, even when he or she is visiting another amateur's station
D. With the name and location of the station licensee, followed by the two-letter designation of the nearest FCC Field Office

The answer is B. Identification is made in accordance with the answer to Question 2A-27.1. Your call sign should be given in plain English or International Morse code.

2A-27.3 What station identification, if any, is required at the beginning of communication?

A. The operator originating the contact must transmit both call signs
B. No identification is required at the beginning of the contact
C. Both operators must transmit their own call signs
D. Both operators must transmit both call signs

The answer is B. Station identification is NOT required at the beginning of a QSO. See question 2A-27.1.

2A-27.4 What station identification, if any, is required at the end of a communication?

A. Both stations must transmit their own call sign, assuming they are FCC-licensed
B. No identification is required at the end of the contact
C. The station originating the contact must always transmit both call signs
D. Both stations must transmit their own call sign followed by a two-letter designator for the nearest FCC field office

The answer is A. Station identification IS required at the end of a QSO. See question 2A-27.1.

2A-27.5 What do the FCC Rules for amateur station identification generally require?

A. Each amateur station shall give its call sign at the beginning of each communication, and every ten minutes or less during a communication
B. Each amateur station shall give its call sign at the end of each communication, and every ten minutes or less during a communication
C. Each amateur station shall give its call sign at the beginning of each communication, and every five minutes or less during a communication
D. Each amateur station shall give its call sign at the end of each communication, and every five minutes or less during a communication

The answer is B. See question 2A-27.1.

2A-27.6 What is the fewest number of times you must transmit your amateur station identification during a 25 minute QSO?

A. 1 B. 2 C. 3 D. 4

The answer is C. He must identify first after 10 minutes, a second time after 20 minutes, and a third time at the end of the QSO.

2A-27.7 What is the longest period of time during a QSO that an amateur station does not need to transmit its station identification?

A. 5 minutes B. 10 minutes C. 15 minutes D. 20 minutes

The answer is B. See answer to question 2A-27.1.

2A-28.1 With which amateur stations may an FCC-licensed amateur station communicate?

A. All amateur stations
B. All public noncommercial radio stations unless prohibited by the station's government
C. Only with US amateur stations
D. All amateur stations, unless prohibited by the amateur's government

The answer is D. An FCC-licensed amateur station may communicate with all other licensed amateur stations. He may NOT communicate with a foreign-licensed amateur if our government, or the government of that particular amateur, has given notice that it objects to such radiocommunications.

2A-28.2 With which non-amateur stations may an FCC-licensed amateur station communicate?

A. No non-amateur stations
B. All such stations
C. Only those authorized by the FCC
D. Only those who use the International Morse code

The answer is C. FCC-licensed amateurs may communicate with the following groups of non-amateur stations in the listed situations:

(1) Stations in other services, licensed by the Commission and with United States Government stations for civil defense purposes.

(2) Any other station in an emergency.

(3) Other stations, for test purposes, on a temporary basis.

(4) Any station which is authorized by the Commission to communicate with amateur stations.

2A-29.1 When must the licensee of an amateur station in portable or mobile operation notify the FCC?

A. One week in advance if the operation will last for more than 24 hours
B. FCC notification is not required for portable or mobile operation
C. One week in advance if the operation will last for more than a week
D. One month in advance of any portable or mobile operation

The answer is B. There are, however, certain conditions which must be met when operating portable or mobile outside the jurisdiction of the United States.

2A-29.2 When may you operate your amateur station at a location within the United States, its territories or possessions other than the one listed on your station license?

A. Only during times of emergency
B. Only after giving proper notice to the FCC
C. During an emergency or an FCC-approved emergency preparedness drill
D. Whenever you want to

The answer is D. See answer 2A-29.1.

2A-30.1 When are communications pertaining to business or commercial affairs of any party permitted in the amateur service?

A. Only when the immediate safety of human life or immediate protection of property is threatened
B. There are no rules against conducting business communications in the amateur service
C. No business communications of any kind are ever permitted in the amateur service
D. Business communications are permitted between the hours of 9 AM to 5 PM, only on weekdays

The answer is A. Aside from answer A above, business communications are not permitted in the amateur service. See answer 2A-30.2.

2A-30.2 You wish to obtain an application for membership in the American Radio Relay League. When would you be permitted to send an Amateur Radio message requesting the application?

A. At any time, since the ARRL is a not-for-profit organization
B. Never. This would facilitate the commercial affairs of the ARRL
C. Only during normal business hours, between 9 AM and 5 PM
D. At any time, since there are no rules against conducting business communications in the amateur service

The answer is B. A business communication is defined as: any transmission or communication, the purpose of which is to facilitate the regular business or commercial affairs of any party.

2A-30.3 On your way home from work you decide to order pizza for dinner. When would you be permitted to use the autopatch on your radio club repeater to order the pizza?

A. At any time, since you will not profit from the communications
B. Only during normal business hours, between 9 AM and 5 PM
C. At any time, since there are no rules against conducting business communications in the amateur service
D. Never. This would facilitate the commercial affairs of a business

The answer is D. See answers 2A-30.1 and 2A-30.2.

One question must be from the following:

2A-31.1 When may an FCC-licensed amateur operator communicate with an amateur operator in a foreign country?

A. Only when the foreign operator uses English as his primary language
B. All the time, except on 28.600 to 29.700 MHz
C. Only when a third party agreement exists between the US and the foreign country
D. At any time unless prohibited by either the US or the foreign government

The answer is D. He may communicate with a station in a foreign

country, unless the administration of that particular country, or our government, has served notice that it objects to such communications.

2A-32.1 When may an amateur station be used to transmit messages for hire?

A. Under no circumstances may an amateur station be hired to transmit messages
B. Modest payment from a non-profit charitable organization is permissible
C. No money may change hands, but a radio amateur may be compensated for services rendered with gifts of equipment or services rendered as a returned favor
D. All payments received in return for transmitting messages by amateur radio must be reported to the IRS

The answer is A. An amateur station shall not be used to transmit or receive messages for hire, nor for communication for material compensation, direct or indirect, paid or promised.

2A-32.2 When may the control operator be paid to transmit messages from an amateur station?

A. The control operator may be paid if he or she works for a public service agency such as the Red Cross
B. The control operator may not be paid under any circumstances
C. The control operator may be paid if he or she reports all income earned from operating an amateur station to the IRS as receipt of tax-deductible contributions
D. The control operator may accept compensation if he or she works for a club station during the period in which the station is transmitting telegraphy practice or information bulletins if certain exacting conditions are met

The answer is D. Control operators may normally not be compensated for transmitting messages at an amateur station. However, a club station control operator may be compensated when the club station is operated primarily for the purpose of conducting amateur communication to provide telegraphy practice transmissions intended for persons learning or improving proficiency in the International Morse code, or to disseminate information bulletins consisting solely of subject matter having direct interest to the amateur service.

Control operators may accept compensation only for such periods of time during which the station is transmitting telegraphy practice or bulletins.

2A-33.1 When is an amateur operator permitted to broadcast information intended for the general public?

A. amateur operators are not permitted to broadcast information intended for the general public

B. Only when the operator is being paid to transmit the information
C. Only when such transmissions last less than 1 hour in any 24-hour period
D. Only when such transmissions last longer than 15 minutes

The answer is A. In addition, an amateur station shall not engage in program production or newsgathering for broadcast purposes, and shall not retransmit programs or signals emanating from any class of radio station other than amateur, except for emergency communications.

2A-34.1 What is third-party communications?

A. A message passed from the control operator of an amateur station to another control operator on behalf of another person
B. Public service communications handled on behalf of a minor political party
C. Only messages that are formally handled through amateur radio channels
D. A report of highway conditions transmitted over a local repeater

The answer is A. Third party traffic is amateur communication by or under the supervision of the control operator at an amateur station on behalf of anyone other than the control operators of the two stations.

2A-34.2 Who is a third-party in amateur communications?

A. The amateur station that breaks into a two-way contact between two other amateur stations
B. Any person for whom a message is passed through amateur communication channels other than the control operators of the two stations handling the message
C. A shortwave listener monitoring a two-way amateur communication
D. The control operator present when an unlicensed person communicates over an amateur station

The answer is B. See answer to question 2A-34-1. A third party is the person on whose behalf a message is being sent. A third party may also participate in amateur radio. He can talk into the microphone as long as a licensed amateur is operating and controlling the station. In other words, a third party is the person who is NOT OPERATING the station, but who is either participating in the station activities or on whose behalf a message is being sent.

2A-34.3 When is an amateur operator permitted to transmit a message to a foreign country for a third party?

A. Anytime
B. Never
C. Anytime, unless there is a third-party traffic agreement between the US and the foreign government
D. When there is a third-party traffic agreement between the US and the foreign government, or when the third party is eligible to be the

control operator of the station
The answer is D. See answer 2A-34.2.

2A-35.1 Is an amateur station permitted to transmit music?
A. The transmission of music is not permitted in the amateur service
B. When the music played produces no dissonances or spurious emissions
C. When it is used to jam an illegal transmission
D. Only above 1280 MHz
The answer is A.

2A-36.1 Is the use of codes or ciphers where the intent is to obscure the meaning permitted in the amateur service?
A. Codes and ciphers are permitted during ARRL-sponsored contests
B. Codes and ciphers are permitted during nationally declared emergencies
C. The transmission of codes and ciphers where the intent is to obscure the meaning is not permitted in the amateur service
D. Codes and ciphers are permitted above 1280 MHz
The answer is C. The transmission by radio of messages in codes or ciphers in domestic and international communications, to or between amateur stations, is prohibited. All communications, regardless of type of emission employed, shall be in plain language, except that generally recognized abbreviations established by regulation or custom and usage are permissible, as are any other abbreviations or signals where the intent is not to obscure the meaning, but only to facilitate communications.

2A-36.2 When is an operator in the amateur service permitted to use abbreviations that are intended to obscure the meaning of the message?
A. Only during ARRL-sponsored contests
B. Only on frequencies above 222.5 MHz
C. Only during a declared communications emergency
D. Abbreviations that are intended to obscure the meaning of the message may never be used in the amateur service
The answer is D. See question 2A-36.1.

One question must be from the following:

2A-37.1 Under what circumstances, if any, may the control operator cause false or deceptive signals or communications to be transmitted?
A. Under no circumstances
B. When operating a beacon transmitter in a "fox hunt" exercise
C. When playing a harmless "practical joke" without causing interference to other stations that are not involved

D. When you need to obscure the meaning of transmitted information to ensure secrecy

The answer is A.

2A-37.2 If an amateur operator transmits the word "MAYDAY" when no actual emergency has occurred, what is this called?

A. A traditional greeting in May
B. An Emergency Action System test transmission
C. False or deceptive signals
D. "MAYDAY" has no significance in an emergency situation

The answer is C. The transmission of false or deceptive signals is forbidden.

2A-38.1 When may an amateur station transmit unidentified communications?

A. A transmission need not be identified if it is restricted to brief tests not intended for reception by other parties
B. A transmission need not be identified when conducted on a clear frequency or "dead band" where interference will not occur
C. An amateur operator may never transmit unidentified communications
D. A transmission need not be identified unless two-way communications or third-party traffic handling are involved

The answer is C. Under NO circumstances may a control operator cause unidentified communications to be transmitted.

2A-38.2 What is the meaning of the term unidentified radio communications or signals?

A. Radio communications in which the transmitting station's call sign is transmitted in modes other than CW and voice
B. Radio communications approaching a receiving station from an unknown direction
C. Radio communications in which the operator fails to transmit his or her name and QTH
D. Radio communications in which the station identification is not transmitted

The answer is D. Unidentified radio communications or signals are emissions from a station without any station identification from the operator sending them.

2A-38.3 What is the term used to describe a transmission from an amateur that does not transmit the required station identification?

A. Unidentified communications or signals
B. Reluctance modulation
C. NØN emission
D. Tactical communication

The answer is A.

2A-39.1 When may an amateur operator willfully or maliciously

interfere with a radio communication or signal?

A. You may jam another person's transmissions if that person is not operating in a legal manner
B. You may interfere with another station's signals if that station begins transmitting on a frequency already occupied by your station
C. You may never willfully or maliciously interfere with another station's transmissions
D. You may expect, and cause, deliberate interference because it is unavoidable during crowded band conditions

The answer is C.

2A-39.2 What is the meaning of the term malicious interference?

A. Accidental interference
B. Intentional interference
C. Mild interference
D. Occasional interference

The answer is B. Malicious interference means to willfully or deliberately interfere with unlawful intention.

2A-39.3 What is the term used to describe an Amateur Radio transmission that is intended to disrupt other communications in progress?

A. Interrupted CW
B. Malicious interference
C. Transponded signals
D. Unidentified transmissions

The answer is B.

2A-40.1 As an amateur operator, you receive an Official Notice of Violation from the FCC. How promptly must you respond?

A. Within 90 days
B. Within 30 days
C. As specified in the Notice
D. The next day

The answer is C.

2A-40.2 If you were to receive a voice distress signal from a station on a frequency outside your operator privileges, what restrictions would apply to assisting the station in distress?

A. You would not be allowed to assist the station because the frequency of its signals were outside your operator privileges
B. You would be allowed to assist the station only if your signals were restricted to the nearest frequency band of your privileges
C. You would be allowed to assist the station on a frequency outside of your operator privileges only if you used international Morse code
D. You would be allowed to assist the station on a frequency outside of your operator privileges using any means of radiocommunications at your disposal

The answer is D.

2A-40.3 If you were in a situation where normal communication systems were disrupted due to a disaster, what restrictions would apply to essential communications you might provide in connection

with the immediate safety of human life?

A. You would not be able to communicate at all except to the FCC Engineer in Charge of the area concerned
B. You would be restricted to communications using only the emissions and frequencies authorized to your operator privileges
C. You would be allowed to communicate on frequencies outside your operator privileges only if you used international Morse code
D. You would be allowed to use any means of radio communication at your disposal

The answer is D.

SUBELEMENT 2B
Operating Procedures
(2 Questions)

One question must be from the following:

2B-1-1.1 What is the most important factor to consider when selecting a transmitting frequency within your authorized subband?

A. The frequency should not be in use by other amateurs
B. You should be able to hear other stations on the frequency to ensure that someone will be able to hear you
C. Your antenna should be resonant at the selected frequency
D. You should ensure that the SWR on the antenna feed line is high enough at the selected frequency

The answer is A. Take the necessary time to make sure that the frequency is not in use. It is most important not to interfere with others. To make certain that the frequency is not in use, you can transmit the question "Is this frequency in use?"

2B-1-1.2 You wish to contact an amateur station more than 1500 miles away on a summer afternoon. Which band is most likely to provide a successful contact?

A. The 80- or 40-meter wavelength bands
B. The 40- or 15-meter wavelength bands
C. The 15- or 10-meter wavelength bands
D. The 1-1/4 meter or 23-centimeter wavelength bands

The answer is C. The 10 and 15 meter wavelength bands generally provide longer distance contacts than the 40 and 80 meter wavelength bands. The 1-1/4 meter and 23 centimeter wavelength bands are short distance bands.

2B-1-1.3 How can on-the-air transmitter tune-up be kept as short as possible?

A. By using a random wire antenna
B. By tuning up on 40 meters first, then switching to the desired band
C. By tuning the transmitter into a dummy load
D. By using twin lead instead of coaxial-cable feed lines

The answer is C. A dummy antenna should be used in place of the actual antenna during testing and tune-up procedures. A dummy antenna is a resistance load that presents the same resistance and power dissipation to the final stage as the antenna does. A dummy antenna is located right in the amateur station's operating room and converts the

transmitter's output power into heat. This prevents the signals from getting out on the air during these procedures. After the tuning and testing procedures have been completed using the dummy load, the antenna can be switched in and the final "touch-up" tuning, which should take very little time, can then be done.

It is a good idea to reduce power to the final stage when tuning up. This will prevent possible damage to the equipment.

2B-1-2.1 You are having a QSO with your uncle in Pittsburgh when you hear an emergency call for help on the frequency you are using. What should you do?

A. Inform the station that the frequency is in use
B. Direct the station to the nearest emergency net frequency
C. Call your local Civil Preparedness Office and inform them of the emergency
D. Immediately stand by to copy the emergency communication

The answer is D. Emergency communications have priority over all other communications.

2B-2-1.1 What is the format of a standard Morse code CQ call?

A. Transmit the procedural signal "CQ" three times, followed by the procedural signal "DE", followed by your call three times
B. Transmit the procedural signal "CQ" three times, followed by the procedural signal "DE", followed by your call one time
C. Transmit the procedural signal "CQ" ten times, followed by the procedural signal "DE", followed by your call one time
D. Transmit the procedural signal "CQ" continuously until someone answers your call

The answer is A. An example would be: CQ CQ CQ DE KE2AF KE2AF KE2AF.

2B-2-1.2 How should you answer a Morse code CQ call?

A. Send your call sign four times
B. Send the other station's call sign twice, followed by the procedural signal "DE", followed by your call sign twice
C. Send the other station's call sign once, followed by the procedural signal "DE", followed by your call sign four times
D. Send your call sign followed by your name, station location and a signal report

The answer is B. An example would be: KE2AF KE2AF DE W2OSH W2OSH.

2B-2-2.1 At what telegraphy speed should a "CQ" message be transmitted?

A. Only speeds below five WPM

B. The highest speed your keyer will operate
C. Any speed at which you can reliably receive
D. The highest speed at which you can control the keyer

The answer is C. An operator should send a CQ at the speed that he can receive CW. The other station will generally answer a CQ at the speed of the CQ. If an amateur sends CQ at a speed higher than he can copy, he will have difficulty when the other station comes back to him at the speed of the CQ.

In general, an amateur should always lower his code speed to accommodate the other amateur.

2B-2-3.1 What is the meaning of the Morse code character AR?
A. Only the called station transmit
B. All received correctly
C. End of transmission
D. Best regards

The answer is C. AR indicates the end of a message unit or transmission.

2B-2-3.2 What is the meaning of the Morse code character SK?
A. Received some correctly
B. Best regards
C. Wait
D. End of contact

The answer is D. SK indicates the end of the ENTIRE transmission or contact.

2B-2-3.3 What is the meaning of the Morse code character BT?
A. Double dash "="
B. Fraction bar "/"
C. End of contact
D. Back to you

The answer is A.

2B-2-3.4 What is the meaning of the Morse code character DN?
A. Double dash "="
B. Fraction bar "/"
C. Done now (end of contact)
D. Called station only transmit

The answer is B.

2B-2-3.5 What is the meaning of the Morse code character KN?
A. Fraction bar "/"
B. End of contact
C. Called station only transmit
D. Key now (go ahead to transmit)

The answer is C.

2B-2-4.1 What is the procedural signal "CQ" used for?
A. To notify another station that you will call on the quarter hour
B. To indicate that you are testing a new antenna and are not listening for another station to answer
C. To indicate that only the called station should transmit

D. A general call when you are trying to make a contact

The answer is D. CQ is a general inquiry call that is used when an amateur is trying to make a contact with anyone.

2B-2-4.2 What is the procedural signal "DE" used for?

A. To mean "from" or "this is," as in "W9NGT de N9BTT"
B. To indicate directional emissions from your antenna
C. To indicate "received all correctly"
D. To mean "calling any station"

The answer is A. DE means "from". It is followed by the call letters of the station doing the sending.

2B-2-4.3 What is the procedural signal "K" used for?

A. To mean "any station transmit"
B. To mean "all received correctly"
C. To mean "end of message"
D. To mean "called station only transmit"

The answer is A. K means "go ahead". It is used after a CQ or at the end of a single transmission.

2B-2-5.1 What does the R in the RST signal report mean?

A. The recovery of the signal
B. The resonance of the CW tone
C. The rate of signal flutter
D. The readability of the signal

The answer is D. The R stands for readability and is rated on a scale of 1 to 5. The higher the number, the better is the readability. See Appendix 3.

2B-2-5.2 What does the S in the RST signal report mean?

A. The scintillation of a signal
B. The strength of the signal
C. The signal quality
D. The speed of the CW transmission

The answer is B. The RST reporting system is a means of rating the quality of a signal on a numerical basis.

The S stands for signal strength, and is rated on a scale of 1 to 9. The higher the number, the greater is the signal strength.

The complete RST reporting system is given in Appendix 3, page AP-3.

2B-2-5.3 What does the T in the RST signal report mean?

A. The tone of the signal
B. The closeness of the signal to "telephone" quality
C. The timing of the signal dot to dash ratio
D. The tempo of the signal

The answer is A. The "T" report is used only for CW signals. The T indicates the quality of a CW tone and is rated on a scale of 1 to 9. The

higher the number, the cleaner is the tone. If the tone is really clean, as though it came from a crystal controlled transmitter, an "X" may be added to the "T" report. See Appendix 3.

2B-2-6.1 What is one meaning of the Q signal "QRS"?
A. Interference from static
B. Send more slowly
C. Send RST report
D. Radio station location is

The answer is B. Abbreviations starting with a Q are known as Q signals. When a Q signal is followed by a question mark, it takes the form of a question. When the Q signal is not followed by a question mark, it indicates either a reply to a Q signal question or a direct statement. For instance, QRS? means "Shall I send slower?" QRS, without the question mark, means "Send slower".

2B-2-6.2 What is one meaning of the Q signal "QRT"?
A. The correct time is
B. Send RST report
C. Stop sending
D. Send more slowly

The answer is C. See answer 2B-2-6.1.

2B-2-6.3 What is one meaning of the Q signal "QTH"?
A. Time here is
B. My name is
C. Stop sending
D. My location is ...

The answer is D. See answer 2B-2-6.1.

2B-2-6.4 What is one meaning of the Q signal "QRZ," when it is followed with a question mark?
A. Who is calling me?
B. What is your radio zone?
C. What time zone are you in?
D. Is this frequency in use?

The answer is A. See answer 2B-2-6.1. QRZ is usually used when an amateur thinks he hears someone calling him and has missed the call sign of the other amateur.

2B-2-6.5 What is one meaning of the Q signal "QSL," when it is followed with a question mark?
A. Shall I send you my log?
B. Can you acknowledge receipt (of my message)?
C. Shall I send more slowly?
D. Who is calling me?

The answer is B. See answer 2B-2-6.1.

2B-3-1.1 What is the format of a standard radiotelephone CQ call?
A. Transmit the phrase "CQ" at least ten times, followed by "this is," followed by your call sign at least two times
B. Transmit the phrase "CQ" at least five times, followed by "this is," followed by your call sign once

C. Transmit the phrase "CQ" three times, followed by "this is," followed by your call sign three times
D. Transmit the phrase "CQ" at least ten times, followed by "this is," followed by your call sign once

The answer is C. Sending CQ more than three times wastes time and is an unnecessary use of the airways. If it is sent less than three times, it will easily be missed.

2B-3-1.2 How should you answer a radiotelephone CQ call?

A. Transmit the other station's call sign at least ten times, followed by "this is," followed by your call sign at least twice
B. Transmit the other station's call sign at least five times phonetically, followed by "this is," followed by your call sign at least once
C. Transmit the other station's call sign at least three times, followed by "this is," followed by your call sign at least five times phonetically
D. Transmit the other station's call sign once, followed by "this is," followed by your call sign given phonetically

The answer is D. An example of this would be: W2OSH, this is KE2AF, Kilo Echo Two Alpha Foxtrot, over.

2B-3-2.1 How is the call sign "KA3BGQ" stated in Standard International Phonetics?

A. Kilo Alfa Three Bravo Golf Quebec
B. King America Three Bravo Golf Quebec
C. Kilowatt Alfa Three Bravo George Queen
D. Kilo America Three Baker Golf Quebec

The answer is A. If conditions are poor during telephony operation, or if you feel that you may not be understood, phonetics should be used. The International Telecommunication Union (ITU) recommends the following phonetic alphabet:

A - Alpha	G - Golf	N - November	U - Uniform
B - Bravo	H - Hotel	O - Oscar	V - Victor
C - Charlie	I - India	P - Papa	W - Whiskey
D - Delta	J - Juliette	Q - Quebec	X - Xray
E - Echo	K - Kilo	R - Romeo	Y - Yankee
F - Foxtrot	L - Lima	S - Sierra	Z - Zulu
	M - Mike	T - Tango	

2B-3-2.2 How is the call sign "WE5TZD" stated phonetically?

A. Whiskey Echo Foxtrot Tango Zulu Delta
B. Washington England Five Tokyo Zanzibar Denmark
C. Whiskey Echo Five Tango Zulu Delta
D. Whiskey Easy Five Tear Zebra Dog

The answer is C. See answer 2B-3-2.1.

2B-3-2.3 How is the call sign "KC4HRM" stated phonetically?
A. Kilo Charlie Four Hotel Romeo Mike
B. Kilowatt Charlie Four Hotel Roger Mexico
C. Kentucky Canada Four Honolulu Radio Mexico
D. King Charlie Foxtrot Hotel Roger Mary
The answer is A. See answer 2B-3-2.1.

2B-3-2.4 How is the call sign "AF6PSQ" stated phonetically?
A. America Florida Six Portugal Spain Quebec
B. Adam Frank Six Peter Sugar Queen
C. Alfa Fox Sierra Papa Santiago Queen
D. Alfa Foxtrot Six Papa Sierra Quebec
The answer is D. See answer 2B-3-2.1.

2B-3-2.5 How is the call sign "NB8LXG" stated phonetically?
A. November Bravo Eight Lima Xray Golf
B. Nancy Baker Eight Love Xray George
C. Norway Boston Eight London Xray Germany
D. November Bravo Eight London Xray Germany
The answer is A. See answer 2B-3-2.1.

2B-3-2.6 How is the call sign "KJ1UOI" stated phonetically?
A. King John One Uncle Oboe Ida
B. Kilowatt George India Uncle Oscar India
C. Kilo Juliette One Uniform Oscar India
D. Kentucky Juliette One United Ontario Indiana
The answer is C. See answer to question 2B-3-2.1.

2B-3-2.7 How is the call sign "WV2BPZ" stated phonetically?
A. Whiskey Victor Two Bravo Papa Zulu
B. Willie Victor Two Baker Papa Zebra
C. Whiskey Victor Tango Bravo Papa Zulu
D. Willie Virginia Two Boston Peter Zanzibar
The answer is A. See answer to question 2B-3-2.1.

2B-3-2.8 How is the call sign "NY3CTJ" stated phonetically?
A. Norway Yokohama Three California Tokyo Japan
B. Nancy Yankee Three Cat Texas Jackrabbit
C. Norway Yesterday Three Charlie Texas Juliette
D. November Yankee Three Charlie Tango Juliette
The answer is D. See answer to question 2B-3-2.1.

2B-3-2.9 How is the call sign "KG7DRV" stated phonetically?
A. Kilo Golf Seven Denver Radio Venezuela
B. Kilo Golf Seven Delta Romeo Victor

C. King John Seven Dog Radio Victor
D. Kilowatt George Seven Delta Romeo Video
The answer is B. See answer to question 2B-3-2.1.

2B-3-2.10 How is the call sign "WX9HKS" stated phonetically?
A. Whiskey Xray Nine Hotel Kilo Sierra
B. Willie Xray November Hotel King Sierra
C. Washington Xray Nine Honolulu Kentucky Santiago
D. Whiskey Xray Nine Henry King Sugar
The answer is A. See answer to question 2B-3-2.1.

2B-3-2.11 How is the call sign "AEØLQY" stated phonetically?
A. Able Easy Zero Lima Quebec Yankee
B. Arizona Ecuador Zero London Queen Yesterday
C. Alfa Echo Zero Lima Quebec Yankee
D. Able Easy Zero Love Queen Yoke
The answer is C. See answer to question 2B-3-2.1.

One question must be from the following:

2B-4-1.1 What is the format of a standard RTTY CQ call?
A. Transmit the phrase "CQ" three times, followed by "DE", followed by your call sign two times
B. Transmit the phrase "CQ" three to six times, followed by "DE," followed by your call sign three times
C. Transmit the phrase "CQ" ten times, followed by the procedural signal "DE", followed by your call one time
D. Transmit the phrase "CQ" continuously until someone answers your call
The answer is B.

2B-4-2.1 You receive an RTTY CQ call at 45 bauds. At what speed should you respond?
A. 22-1/2 bauds
B. 45 bauds
C. 90 bauds
D. Any speed, since radioteletype systems adjust to any signal rate
The answer is B. The basic RTTY equipment is set up to send and receive at the same speed.

2B-5-1.1 What does the term <u>connected</u> mean in a packet-radio link?
A. A telephone link has been established between two amateurs
B. An amateur radio message has reached the station for local delivery
C. The transmitting station is sending data specifically addressed to the receiving station, and the receiving station is acknowledging that the

data has been received correctly
D. The transmitting station and a receiving station are using a certain digipeater, so no other contacts can take place until they are finished

The answer is C. "Connected" indicates that a contact has been made and messages can be exchanged. Packet radio uses an automatic system where the stations are continuously checking each other to make certain that everything is being received O.K.

2B-5-1.2 What does the term monitoring mean on a frequency used for packet radio?

A. The FCC is copying all messages to determine their content
B. A member of the Amateur Auxiliary to the FCC's Field Operations Bureau is copying all messages to determine their content
C. The receiving station's video monitor is displaying all messages intended for that station, and is acknowledging correct receipt of the data
D. The receiving station is displaying information that may not be addressed to that station, and is not acknowledging correct receipt of the data

The answer is D.

2B-5-2.1 What is a digipeater?

A. A packet-radio station used to retransmit data that is specifically addressed to be retransmitted by that station
B. An amateur radio repeater designed to retransmit all audio signals in a digital form
C. An amateur radio repeater designed using only digital electronics components
D. A packet-radio station that retransmits any signals it receives

The answer is A. A digipeater is actually a digital repeater. It retransmits information received. It does not require an operator to be present; however, its power must be on. The "digipeat" command can be turned off if the operator doesn't wish to use the station as a digipeater.

2B-5-2.2 What is the meaning of the term network in packet radio?

A. A system of telephone lines interconnecting packet-radio stations to transfer data
B. A method of interconnecting packet-radio stations so that data can be transferred over long distances
C. The interlaced wiring on a terminal-node-controller board
D. The terminal-node-controller function that automatically rejects another caller when the station is connected

The answer is B. The network involves a large number of stations using common protocols.

2B-6-1.1 What is a good way to establish a contact on a repeater?
A. Give the call sign of the station you want to contact three times
B. Call the other operator by name and then give your call sign three times
C. Call the desired station and then identify your own station
D. Say, "Breaker, breaker," and then give your call sign

The answer is C. A repeater is a receiver-transmitter device that receives a signal on one frequency and automatically retransmits it on another frequency. The repeater is located on a hill or other high point, and its purpose is to extend the range of communications of low power hand-held and mobile stations. The low power station transmits to a nearby repeater. The repeater then retransmits the signal over a much greater distance than the low power station could transmit.

If you wish to use a repeater, you should, with a brief call, make your presence known. Do not call CQ. If you wish to call someone, then call that station and give your own call.

2B-6-2.1 What is the main purpose of a repeater?
A. To provide a station that makes local information available 24 hours a day
B. To provide a means of linking amateur stations with the telephone system
C. To retransmit NOAA weather information during severe storm warnings
D. Repeaters extend the operating range of portable and mobile stations

The answer is D. See answer 2B-6-1.1.

2B-6-3.1 What does it mean to say that a repeater has an input and an output frequency?
A. The repeater receives on one frequency and transmits on another
B. All repeaters offer a choice of operating frequency, in case one is busy
C. One frequency is used to control repeater functions and the other frequency is the one used to retransmit received signals
D. Repeaters require an access code to be transmitted on one frequency while your voice is transmitted on the other

The answer is A. See answer 2B-6-1.1.

2B-6-4.1 When should simplex operation be used instead of using a repeater?
A. Whenever greater communications reliability is needed
B. Whenever a contact is possible without using a repeater
C. Whenever you need someone to make an emergency telephone call
D. Whenever you are traveling and need some local information

The answer is B. Simplex means "alternating transmissions between two or more stations, using one frequency". It is communicating with

another station directly, instead of using a repeater. Simplex should always be used, where possible, instead of tying up a repeater.

2B-6-5.1 What is an autopatch?

A. A repeater feature that automatically selects the strongest signal to be repeated
B. An automatic system of connecting a mobile station to the next repeater as it moves out of range of the first
C. A device that allows repeater users to make telephone calls from their portable or mobile stations
D. A system that automatically locks other stations out of the repeater when there is a QSO in progress

The answer is C. An autopatch is a device that interconnects between the repeater station and the telephone lines. Thus, an amateur who is in contact with a repeater from his portable or mobile station, can contact someone by telephone via the repeater.

2B-6-5.2 What is the purpose of a repeater time-out timer?

A. It allows the repeater to have a rest period after heavy use
B. It logs repeater transmit time to determine when the repeater mean time between failure rating is exceeded
C. It limits repeater transmission time to no more than ten minutes
D. It limits repeater transmission time to no more than three minutes

The answer is D. Paragraph 97.213(b) states that "Provisions must be incorporated to limit transmission to a period of no more than 3 minutes in the event of malfunction in the control link."

SUBELEMENT 2C
Radio Wave Propagation
(1 Question)

One question must be from the following:

2C-1.1 What type of radio-wave propagation occurs when the signal travels in a straight line from the transmitting antenna to the receiving antenna?

A. Line-of-sight propagation
B. Straight-line propagation
C. Knife-edge diffraction
D. Tunnel propagation

The answer is A. The "line-of-sight" wave is also referred to as the Direct Wave. It is a part of the Ground Wave. The other parts of the Ground Wave are the Surface Wave and the Ground Reflected Wave. The three parts of the Ground Wave are shown in Figure 2C-1.1.

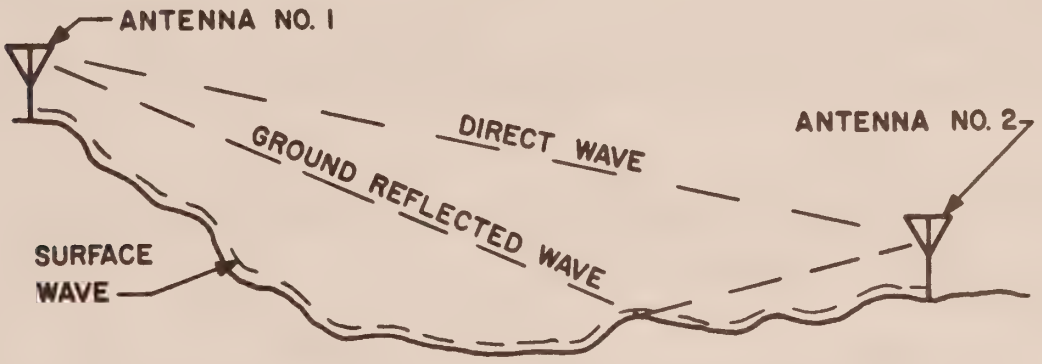


Figure 2C-1.1. Components of the Ground Wave.

2C-1.2 What path do radio waves usually follow from a transmitting antenna to a receiving antenna at VHF and higher frequencies?

A. A bent path through the ionosphere
B. A straight line
C. A great circle path over either the north or south pole
D. A circular path going either east or west from the transmitter

The answer is B. See question 2C-1.1.

2C-2.1 What type of propagation involves radio signals that travel along the surface of the Earth?

A. Sky-wave propagation
B. Knife-edge diffraction
C. E-layer propagation
D. Ground-wave propagation

The answer is D. The ground wave travels along the surface of the earth, gradually losing its strength, until it is completely attenuated. See Figure 2C-1.1.

2C-2.2 What is the meaning of the term ground-wave propagation?
A. Signals that travel along seismic fault lines
B. Signals that travel along the surface of the earth
C. Signals that are radiated from a ground-plane antenna
D. Signals that are radiated from a ground station to a satellite
The answer is B. See answers to questions 2C-1.1 and 2C-2.1.

2C-2.3 Two Amateur Radio stations a few miles apart and separated by a low hill blocking their line-of-sight path are communicating on 3.725 MHz. What type of propagation is probably being used?
A. Tropospheric ducting
B. Ground wave
C. Meteor scatter
D. Sporadic E
The answer is B. The signal travels along the surface of the earth and goes up over the hill and down.

2C-2.4 When compared to sky-wave propagation, what is the usual effective range of ground-wave propagation?
A. Much smaller
B. Much greater
C. The same
D. Dependent on the weather
The answer is A. Ground wave propagation is good up to 50 to 75 miles, whereas sky wave propagation is possible up to thousands of miles.

2C-3.1 What type of propagation uses radio signals refracted back to earth by the ionosphere?
A. Sky wave
B. Earth-moon-earth
C. Ground wave
D. Tropospheric
The answer is A. The term that is given to this type of propagation is **Ionospheric Propagation**. Ionospheric propagation is the propagation of a sky wave that leaves the antenna and travels skyward until it reaches the ionosphere. Here, it is reflected (technically, the term should be "**refracted**") back to earth some distance away. See Figure 2C-3.1.

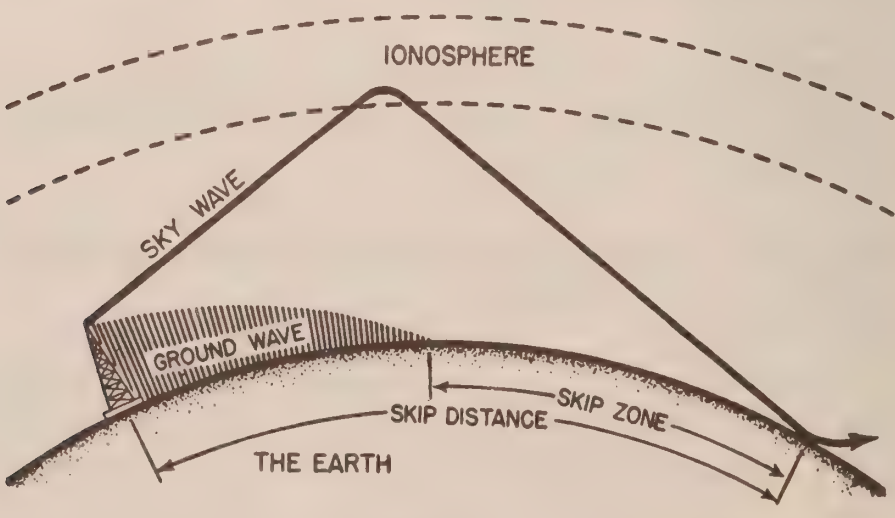


Fig. 2C-3.1. Propagation of Radio Waves.

The terms **Sky Wave Propagation** and **Skip Propagation** are also used to indicate ionospheric propagation.

2C-3.2 What is the meaning of the term sky-wave propagation?
A. Signals reflected from the moon
B. Signals refracted by the ionosphere
C. Signals refracted by water-dense cloud formations
D. Signals retransmitted by a repeater

The answer B. Other terms that are used for signals refracted from the ionosphere are: ionospheric propagation and skip propagation. See Figure 2C-3.1

2C-3.3 What does the term skip mean?
A. Signals are reflected from the moon
B. Signals are refracted by water-dense cloud formations
C. Signals are retransmitted by repeaters
D. Signals are refracted by the ionosphere

The answer is D. **Skip** refers to the fact that the sky wave travels up to the ionosphere and is refracted back to earth, some distance away from the transmitter. It thus "skips" over a portion of the earth. The transmitted signal cannot be heard in the skip zone. See Figure 2C-3.1.

2C-3.4 What is the area of weak signals between the ranges of ground waves and the first hop called?
A. The skip zone
B. The hysteresis zone
C. The monitor zone
D. The transequatorial zone

The answer is A. See Figure 2C-3.1 and answer 2C-3.3.

2C-3.5 What is the meaning of the term skip zone?
A. An area covered by skip propagation
B. The area where a satellite comes close to the earth, and skips off the ionosphere
C. An area that is too far for ground-wave propagation, but too close for skip propagation
D. The area in the atmosphere that causes skip propagation

The answer is C. The **Skip Zone** is the area between the end of the ground wave zone and the point where the sky wave returns to earth. See Figure 2C-3.1 and answer 2C-3.3.

2C-3.6 What type of radio wave propagation makes it possible for amateur stations to communicate long distances?
A. Direct-inductive propagation
B. Knife-edge diffraction
C. Ground-wave propagation
D. Sky-wave propagation

The answer is D. Ionospheric propagation makes this possible. The sky wave that leaves the transmitter strikes the ionosphere and returns back to earth at a point, hundreds or even thousands of miles away. It is possible for the signal to be reflected from the earth and take a second hop, thereby increasing the range of communications.

2C-4.1 How long is an average sunspot cycle?

A. 2 years B. 5 years C. 11 years D. 17 years

The answer is C. Radio communications are greatly affected by the ionosphere. The ionosphere is a gaseous region in the upper atmosphere that extends approximately 40 to 300 miles above the earth. It consists of several layers of ionized particles. The ionization is caused by the air particles being bombarded by the sun's ultra violet rays and cosmic rays. The layers of the ionosphere undergo considerable variations in altitude, density and thickness due to the varying degrees of solar activity. Every 11 years, the concentration of solar radiation into the earth's atmosphere reaches a peak. This peak radiation is accompanied by a large number of dark spots on the sun's surface. These dark spots are referred to as "SUNSPOTS". We refer to the 11 year solar radiation cycle as the "SUNSPOT CYCLE". During periods of maximum sunspot activity, the ionized layers are more dense and occur at higher altitudes. They allow for communications over greater distances. The opposite happens during minimum sunspot activity.

2C-4.2 What is the term used to describe the long-term variation in the number of visible sunspots?

A. The 11-year cycle
B. The Solar magnetic flux cycle
C. The hysteresis count
D. The sunspot cycle

The answer is D. See answer 2C-4.1.

2C-5.1 What affect does the number of sunspots have on the maximum usable frequency (MUF)?

A. The more sunspots there are, the higher the MUF will be
B. The more sunspots there are, the lower the MUF will be
C. The MUF is equal to the square of the number of sunspots
D. The number of sunspots affects the lowest usable frequency (LUF) but not the MUF

The answer is A. The Maximum Usable Frequency (MUF) is the highest frequency that can be used for communication between two specific areas. As the frequency of the signal is increased, a point is reached where the signal penetrates the ionosphere and does not return to earth. When there are more sunspots, solar radiation is greater and the ionized layers are denser and higher. This allows for higher frequencies to be refracted back to earth.

2C-5.2 What affect does the number of sunspots have on the ionization level in the atmosphere?

A. The more sunspots there are, the lower the ionization level will be
B. The more sunspots there are, the higher the ionization level will be
C. The ionization level of the ionosphere is equal to the square root of the number of sunspots
D. The ionization level of the ionosphere is equal to the square of the number of sunspots

The answer is B. See answer 2C-4.1.

2C-6.1 Why can a VHF or UHF radio signal that is transmitted toward a mountain often be received at some distant point in a different direction?

A. You can never tell what direction a radio wave is traveling in
B. These radio signals are easily bent by the ionosphere
C. These radio signals are easily reflected by objects in their path
D. These radio signals are sometimes scattered in the ectosphere

The answer is C.The term "VHF" indicates frequencies from 30 to 300 MHz. The term "UHF" indicates frequencies from 300 to 3000 MHz. Both of these groups of higher frequency signals tend to be reflected more than lower frequency signals.

2C-6.2 Why can the direction that a VHF or UHF radio signal is traveling be changed if there is a tall building in the way?

A. You can never tell what direction a radio wave is traveling in
B. These radio signals are easily bent by the ionosphere
C. These radio signals are easily reflected by objects in their path
D. These radio signals are sometimes scattered in the ectosphere

The answer is C. See answer 2C-6.1.

SUBELEMENT 2D
Amateur Radio Practice
(4 Questions)

One question must be from the following:

2D-1.1 How can you prevent the use of your amateur station by unauthorized persons?

A. Install a carrier-operated relay in the main power line
B. Install a key-operated "ON/OFF" switch in the main power line
C. Post a "Danger - High Voltage" sign in the station
D. Install ac line fuses in the main power line

The answer is B. Some or all of the following measures should be taken to prevent the use of amateur station equipment by unauthorized personnel:

(1) Keep the amateur station room locked when the station is not in use.
(2) Lock the power switch when the station is not being used.
(3) Install a hidden power switch that must be turned on in order to operate the station.
(4) Post a sign in the station room, or on the door of the station room, indicating that only licensed authorized personnel may operate the station.
(5) Post the FCC licenses of those authorized to use the station in the station operating room.

2D-1.2 What is the purpose of a key-operated "ON/OFF" switch in the main power line?

A. To prevent the use of your station by unauthorized persons
B. To provide an easy method for the FCC to put your station off the air
C. To prevent the power company from inadvertently turning off your electricity during an emergency
D. As a safety feature, to kill all power to the station in the event of an emergency

The answer is A. See answer 2D-1.1.

2D-2.1 Why should all antenna and rotator cables be grounded when an amateur station is not in use?

A. To lock the antenna system in one position
B. To avoid radio frequency interference
C. To save electricity
D. To protect the station and building from damage due to a nearby

lightning strike

The answer is D. By removing the antenna cables and rotor cables from the radio equipment and grounding the cables, the path of the lightning will be to **ground** and **not** to the station equipment.

Before a storm, or when the station is not in use, the cables should be disconnected from the equipment, then removed from the home or radio shack, and connected to a good ground outside of the home. A good ground consists of one or more eight foot copper rods, buried in the earth near the base of the antenna tower.

2D-2.2 How can an antenna system be protected from damage caused by a nearby lightning strike?

A. Install a balun at the antenna feed point
B. Install an RF choke in the feed line
C. Ground all antennas when they are not in use
D. Install a line fuse in the antenna wire

The answer is C. The tower and the grounded parts of the antenna system should be permanently connected to a good ground at the base of the tower. During an electrical storm, or when the station is not in use, the antenna and rotor cables should be disconnected from the station equipment and connected to ground. See the answer to question 2D-2.1.

2D-2.3 How can amateur station equipment be protected from damage caused by voltage induced in the power lines by a nearby lightning strike?

A. Use heavy insulation on the wiring
B. Keep the equipment on constantly
C. Disconnect the ground system
D. Disconnect all equipment after use, either by unplugging or by using a main disconnect switch

The answer is D. When the station is not in use, or during electrical storms, the AC power plugs of the equipment should be removed from their outlets. Also, the main power switch controlling the AC power to the station equipment should be shut down.

2D-2.4 For proper protection from lightning strikes, what equipment should be grounded in an amateur station?

A. The power supply primary
B. All station equipment
C. The feed line center conductors
D. The ac power mains

The answer is B. All metal cabinets housing the station equipment should be connected directly to a common point with large diameter, short length conductors. Another heavy conductor should connect this common point to the external ground described in answer 2D-2.1.

The size of the conductor wires that ground the equipment should be #10 or larger.

2D-3.1 What is a convenient indoor grounding point for an amateur station?

A. A metallic cold water pipe
B. PVC plumbing
C. A window screen
D. A natural gas pipe

The answer is A. A metal water pipe can be used, provided it runs directly into the earth.

2D-3.2 To protect against electrical shock hazards, what should you connect the chassis of each piece of your equipment to?

A. Insulated shock mounts
B. The antenna
C. A good ground connection
D. A circuit breaker

The answer is C. They should be connected to a common ground point with large diameter, short lengths of wire. The common ground point should be connected to a good ground, such as the one described in the answer to question 2D-2.1.

2D-3.3 What type of material should a driven ground rod be made of?

A. Ceramic or other good insulator
B. Copper or copper-clad steel
C. Iron or steel
D. Fiberglass

The answer is B. Copper is used because it is a good conductor. The ground rod should be connected to the station ground with a large diameter copper wire or braid. The length of this conductor should be as short as possible.

2D-3.4 What is the shortest ground rod you should consider installing for your amateur station RF ground?

A. 4 foot
B. 6 foot
C. 8 foot
D. 10 foot

The answer is C. The deeper that the rod is driven into the earth, the better is the ground. 8 feet is a good practical size.

One question must be from the following:

2D-4.1 What precautions should you take when working with a 1270-MHz waveguide?

A. Make sure that the RF leakage filters are installed at both ends of the waveguide
B. Never look into the open end of a waveguide when RF is applied
C. Minimize the standing wave ratio before you test the waveguide
D. Never have both ends of the waveguide open at the same time when RF is applied

The answer is B. A waveguide is a transmission line that conducts high frequency energy from one point to another. A waveguide consists of a

rectangular or circular conducting tube through which the energy is transmitted in the form of electromagnetic waves. See Figure 2D-4.1. These waves are both electric and magnetic, and they are propagated through the waveguide tubes by reflections against the inner walls. Skin effect prevents the electromagnetic energy from escaping through the metal walls.

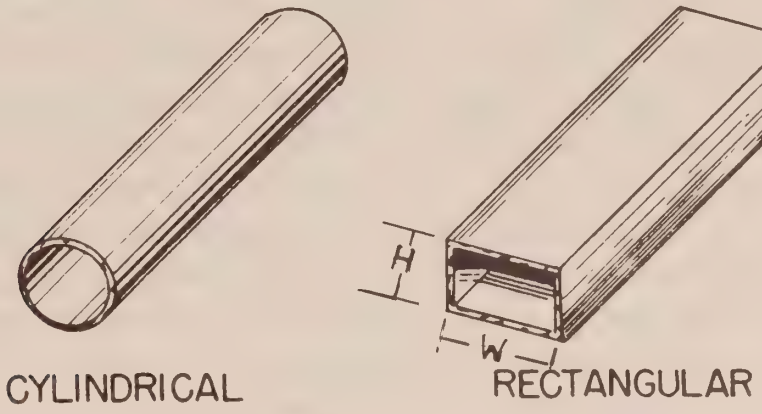


Figure 2D-4.1. Basic forms of waveguides.

The primary reason for using waveguides at high frequencies is that they have low losses. At high frequencies, coaxial cable exhibits very high dielectric losses. Waveguides use air as the dielectric, making the dielectric losses almost negligible.

The reason that you should not look into the open end of a waveguide, when RF is applied to it, is that the RF energy can be harmful to your eyes. See answer 2D-4.2.

2D-4.2 What precautions should you take when you mount a UHF antenna in a permanent location?

A. Make sure that no one can be near the antenna when you are transmitting
B. Make sure that the RF field screens are in place
C. Make sure that the antenna is near the ground to maximize directional effect
D. Make sure you connect an RF leakage filter at the antenna feed point

The answer is A. When RF energy strikes the human body, it causes internal molecular agitation, which in turn, causes heat. The heat can damage the body tissues. The amount of possible damage depends upon the frequency of the RF, the amount of RF power, the type of RF signal, the cumulative amount of exposure and the part of the body that is involved.

As the frequency increases, the RF damage to the body increases. Below 10 MHz, there is minimal effect. At 27 MHz, there is a warming effect on the bones. Continuous exposure to high power VHF (30 to 300 MHz) and UHF (300 to 3000 MHz) radiation, can cause considerable damage to body tissues.

The higher the RF power, the greater are the biological effects. In addition to other reasons, this is one of the most important reasons to use low power. An amateur operator should always use the least amount of power that insures reliable communications. Low power and a good antenna give much better results than a poor antenna with high power.

Fortunately, most amateurs use low power and produce intermittent radiation. More than half of the operating time is spent looking and listening, rather than transmitting. While transmitting, the signal is not always maximum. In CW, there is no RF output a good deal of the time. In single sideband, the peak RF output is only reached a fraction of the time. However, in the case of FM and RTTY, the signal is at peak practically all the time. This fact should be taken into consideration when planning the construction of the station and antenna system.

Different parts of the body react differently to RF. The eyes, testes and ovaries are most susceptible to injury from RF radiation.

The above paragraphs should not cause concern or alarm to prospective amateurs. If common sense is used and safety precautions are observed, an amateur can enjoy a safe hobby for a long, long time. The following safety measures should be taken to insure minimum exposure to RF:

1. Locate the antenna as high as practical and as far away from peoples' living quarters as possible. A directional antenna or dish type antenna should not be pointed in the direction of people.
2. Use good quality coaxial cable. The transmission line should not radiate RF. The antenna should do all the radiating.
3. Use the lowest amount of power to maintain reliable communications.
4. All equipment should be encased in properly shielded, grounded metal cabinets.
5. A good external ground system should be constructed near the antenna system. The grounded cabinets should be connected to this ground.
6. Make certain that the antenna impedance, the transmission line impedance, and the transmitter output impedance are all matched and that the SWR is low.
7. Do not work on the antenna or inside of the transmitter unless you are 100% certain that no one can turn the power on.
8. When working with a hand-held transmitter, keep the antenna away from your head, especially away from your eyes.
9. Do not look into a "live" waveguide. The VHF or UHF energy can be quite harmful to your eyes.
10. If possible, use double shielding on transmission lines and connectors. We want to minimize RF leakage.
11. We must again stress that there should be no cause for alarm or concern if common sense is used with regard to safety measures.

2D-4.3 What precautions should you take before removing the shielding on a UHF power amplifier?
A. Make sure all RF screens are in place at the antenna
B. Make sure the feed line is properly grounded
C. Make sure the amplifier cannot be accidentally energized
D. Make sure that the RF leakage filters are connected
The answer is C. See answer 2D-4.2.

2D-4.4 Why should you use only good-quality, well-constructed coaxial cable and connectors for a UHF antenna system?
A. To minimize RF leakage
B. To reduce parasitic oscillations
C. To maximize the directional characteristics of your antenna
D. To maximize the standing wave ratio of the antenna system
The answer is A. See answer 2D-4.2.

2D-4.5 Why should you be careful to position the antenna of your 220-MHz hand-held transceiver away from your head when you are transmitting?
A. To take advantage of the directional effect
B. To minimize RF exposure
C. To use your body to reflect the signal, improving the directional characteristics of the antenna
D. To minimize static discharges
The answer is B. The eyes are especially sensitive to RF radiation. See answer 2D-4.2.

2D-4.6 Which of the following types of radiation produce health risks most like the risks produced by radio frequency radiation?
A. Microwave oven radiation and ultraviolet radiation
B. Microwave oven radiation and radiation from an electric space heater
C. Radiation from Uranium or Radium and ultraviolet radiation
D. Sunlight and radiation from an electric space heater
The answer is B. Microwave ovens produce energy at approximately 2500 MHz, which is in the RF range. The fields produced by RF and AC power frequencies have similar effects on the human body. Ultraviolet and sunlight radiation produce energy whose frequencies are far removed from the frequencies of RF signals, and their effects on the body are also different.

2D-5.1 Why is there a switch that turns off the power to a high-voltage power supply if the cabinet is opened?
A. To prevent RF from escaping from the supply
B. To prevent RF from entering the supply through the open cabinet
C. To provide a way to turn the power supply on and off

D. To reduce the danger of electrical shock

The answer is D. This switch is referred to as a DOOR INTERLOCK SWITCH. It shuts off the power to the transmitter when the transmitter door is open. The operator is thus protected from contact with high voltages inside of the transmitter.

2D-5.2 What purpose does a safety interlock on an amateur transmitter serve?

A. It reduces the danger that the operator will come in contact with dangerous high voltages when the cabinet is opened while the power is on
B. It prevents the transmitter from being turned on accidentally
C. It prevents RF energy from leaking out of the transmitter cabinet
D. It provides a way for the station licensee to ensure that only authorized operators can turn the transmitter on

The answer is A. See answer 2D-5.1.

2D-6.1 What type of safety equipment should you wear when you are working at the top of an antenna tower?

A. A grounding chain
B. A reflective vest
C. Loose clothing
D. A carefully inspected safety belt

The answer is D.

2D-6.2 Why should you wear a safety belt when you are working at the top of an antenna tower?

A. To provide a way to safely hold your tools so they don't fall and injure someone on the ground
B. To maintain a balanced load on the tower while you are working
C. To provide a way to safely bring tools up and down the tower
D. To prevent an accidental fall

The answer is D. You should also get someone to assist you when doing this type of work.

2D-6.3 For safety purposes, how high should you locate all portions of your horizontal wire antenna?

A. High enough so that a person cannot touch them from the ground
B. Higher than chest level
C. Above knee level
D. Above electrical lines

The answer is A. The horizontal antenna wire should be placed as high as is practical with proper physical supports. Do not use thin tree branches for support, or else, the antenna will be down with the first snow or ice storm. It is important to avoid placing the antenna under electric wires.

The antenna should be high enough so that a person on the ground

cannot touch it. Touching an antenna during high power transmissions can result in electric shock or RF burns.

2D-6.4 What type of safety equipment should you wear when you are on the ground assisting someone who is working on an antenna tower?

A. A reflective vest
B. A safety belt
C. A grounding chain
D. A hard hat

The answer is D. You should wear a helmet (hard hat) to prevent head injuries in the event that any tools or parts are accidentally dropped.

2D-6.5 Why should you wear a hard hat when you are on the ground assisting someone who is working on an antenna tower?

A. To avoid injury from tools dropped from the tower
B. To provide an RF shield during antenna testing
C. To avoid injury if the tower should accidentally collapse
D. To avoid injury from walking into tower guy wires

The answer is A. See answer 2D-6-4.

One question must be from the following:

2D-7-1.1 What accessory is used to measure standing wave ratio?

A. An ohm meter
B. An ammeter
C. An SWR meter
D. A current bridge

The answer is C. The **Standing Wave Ratio (SWR)** is the term that describes the measurement of the impedance match between the transmitter and the antenna or feedline. The formula for Standing Wave Ratio is:

$$SWR = \frac{Z_L}{Z_{TL}}$$

where: Z_L is the impedance of the load and Z_{TL} is the impedance of the transmission line

An SWR of 1 to 1 indicates that the impedances are matched and maximum RF is being transferred between the transmitter and the antenna or feedline. If the impedances are not matched, some of the RF power will be reflected back to the transmitter from the antenna. This will result in an SWR that is greater than 1 to 1, such as 2 to 1 or 3 to 1, etc. Voltage standing wave ratio (VSWR) and standing wave ratio (SWR) are terms that are used interchangeably and mean the same thing. An SWR bridge or Reflectometer is used to measure VSWR.

2D-7-1.2 What instrument is used to indicate the relative impedance match between a transmitter and antenna?

A. An ammeter B. An ohmmeter C. A voltmeter D. An SWR meter

The answer is D. See answer 2D-7-1.1.

2D-7-2.1 What does an SWR-meter reading of 1:1 indicate?
A. An antenna designed for use on another frequency band is probably connected
B. An optimum impedance match has been attained
C. No power is being transferred to the antenna
D. An SWR meter never indicates 1:1 unless it is defective

The answer is B. An SWR of 1:1 is ideal. We try to get as close to this as possible. See answer 2D-7-1.1.

2D-7-2.2 What does an SWR meter reading of less than 1.5:1 indicate?
A. An unacceptably low reading
B. An unacceptably high reading
C. An acceptable impedance match
D. An antenna gain of 1.5

The answer is C. An SWR of less than 1.5 to 1 is very good and is obtainable.

2D-7-2.3 What does an SWR meter reading of 4:1 indicate?
A. An unacceptably low reading
B. An acceptable impedance match
C. An antenna gain of 4
D. An impedance mismatch, which is not acceptable; it indicates problems with the antenna system

The answer is D. An SWR of 4:1 indicates a serious problem. You should not operate with such a high SWR. You should find out the cause and correct it.

2D-7-2.4 What does an SWR-meter reading of 5:1 indicate?
A. The antenna will make a 10-watt signal as strong as a 50- watt signal
B. Maximum power is being delivered to the antenna
C. An unacceptable mismatch is indicated
D. A very desirable impedance match has been attained

The answer is C. See answers 2D-7-1.1 and 2D-7-2.3.

2D-7-3.1 What kind of SWR meter reading may indicate poor electrical contact between parts of an antenna system?
A. An erratic reading
B. An unusually low reading
C. No reading at all
D. A negative reading

The answer is A. A high SWR reading will indicate poor electrical contact between parts of an antenna system. If an antenna system has been operating properly with a low SWR reading for a period of time and suddenly develops a high SWR reading, one should suspect corrosion

at the contacts, or poor electrical contact at other points in the antenna system. If the electrical contact is intermittent, the SWR reading will be erratic.

2D-7-3.2 What does an unusually high SWR meter reading indicate?

A. That the antenna is not the correct length, or that there is an open or shorted connection somewhere in the feed line
B. That the signals arriving at the antenna are unusually strong, indicating good radio conditions
C. That the transmitter is producing more power than normal, probably indicating that the final amplifier tubes or transistors are about to go bad
D. That there is an unusually large amount of solar white- noise radiation, indicating very poor radio conditions

The answer is A. If the antenna length is wrong for the operating frequency, then the impedance of the antenna at the operating frequency will be wrong. An open connection or short will throw the impedance way off.

2D-7-3.3 The SWR meter reading at the low-frequency end of an amateur band is 2.5:1, and the SWR meter reading at the high-frequency end of the same band is 5:1. What does this indicate about your antenna?

A. The antenna is broadbanded
B. The antenna is too long for operation on this band
C. The antenna is too short for operation on this band
D. The antenna has been optimized for operation on this band

The answer is B. Assume that we are referring to the 80 meter band. The question indicates that the antenna's resonant frequency is closer to 3,700 kHz than it is to 3,750 kHz. Since 3,700 kHz has a longer wavelength than 3,750 kHz, the antenna length is too long. See answer 2D-7-3.2.

2D-7-3.4 The SWR meter reading at the low-frequency end of an amateur band is 5:1, and the SWR meter reading at the high-frequency end of the same band is 2.5:1. What does this indicate about your antenna?

A. The antenna is broadbanded
B. The antenna is too long for operation on this band
C. The antenna is too short for operation on this band
D. The antenna has been optimized for operation on this band

The answer is C. Assume that we referring to the 80 meter. The question indicates that the length of the antenna is such that its resonant frequency is closer to 3,750 kHz than it is to 3,700 kHz. The SWR is lowest when the antenna is resonant to the frequency being fed to it.

Since 3,750 kHz has a lower wavelength than 3,700 kHz, the antenna length, which varies directly with wavelength, would be too short. See answers 2D-7-3.2 and 2D-7-3.3.

One question must be from the following:

2D-8-1.1 What is meant by receiver overload?
A. Interference caused by transmitter harmonics
B. Interference caused by overcrowded band conditions
C. Interference caused by strong signals from a nearby transmitter
D. Interference caused by turning the receiver volume too high

The answer is C. Receiver overload refers to a strong fundamental signal from a transmitter that gets into a receiver's front end. Because of its strength, it swamps the receiver's input circuits, which lack the selectivity to suppress the strong signal. The strong interfering signal will generally cause interference over a broad frequency range.

2D-8-1.2 What is a likely indication that radio-frequency interference to a receiver is caused by front-end overload?
A. A low pass filter at the transmitter reduces interference sharply
B. The interference is independent of frequency
C. A high pass filter at the receiver reduces interference little or not at all
D. Grounding the receiver makes the problem worse

The answer is B. The interference covers a wide range of frequencies. In the case of TV overload, it causes image distortion or destruction to most or all channels. See the answer to question 2D-8-1.1.

2D-8-1.3 Your neighbor reports interference to his television whenever you are transmitting from your amateur station. This interference occurs regardless of your transmitter frequency. What is likely to be the cause of the interference?
A. Inadequate transmitter harmonic suppression
B. Receiver VR tube discharge
C. Receiver overload
D. Incorrect antenna length

The answer is C. See answers to questions 2D-8-1.1 and 2D-8-1.2.

2D-8-1.4 What type of filter should be installed on a TV receiver as the first step in preventing RF overload from an amateur HF station transmission?
A. Low pass B. High pass C. Band pass D. Notch

The answer is B. The first step would be to install a high-pass filter at the TV receiver's input. The high-pass filter will pass the high frequency TV signals, but will block the low frequency transmitter signal. It should be installed as close to the TV tuner as possible.

2D-8-2.1 What is meant by harmonic radiation?

A. Transmission of signals at whole number multiples of the fundamental (desired) frequency
B. Transmission of signals that include a superimposed 60-Hz hum
C. Transmission of signals caused by sympathetic vibrations from a nearby transmitter
D. Transmission of signals to produce a stimulated emission in the air to enhance skip propagation

The answer is A. A harmonic is a whole numbered multiple of a fundamental frequency. For instance, if the fundamental frequency is 4.0 MHz, its second harmonic is 8.0 MHz, its third harmonic is 12.0 MHz, etc.

A transmitter will normally generate harmonics along with its fundamental frequency signal. The harmonics will cause interference to other services unless steps are taken to prevent their radiation.

2D-8-2.2 Why is harmonic radiation from an amateur station undesirable?

A. It will cause interference to other stations and may result in out-of-band signal radiation
B. It uses large amounts of electric power
C. It will cause sympathetic vibrations in nearby transmitters
D. It will produce stimulated emission in the air above the transmitter, thus causing aurora

The answer is A. Harmonic radiation is undesirable because it may cause interference to other services. For instance, if an amateur is operating at 29 MHz, the second harmonic is 58 MHz. If a 58 MHz harmonic is radiated from the transmitter, it would interfere with TV channel 2 which occupies the band of frequencies from 54 to 60 MHz.

2D-8-2.3 What type of interference may radiate from a multi-band antenna connected to an improperly tuned transmitter?

A. Harmonic radiation
B. Auroral distortion
C. Parasitic excitation
D. Intermodulation

The answer is A. It will radiate harmonic interference. This is because a multi-band antenna is designed to operate at several frequencies that are harmonically related. An antenna tuner and/or a low pass filter should be used when using a multi-band antenna. The antenna tuner has tuned circuits that select the desired signal and reject other signals. The low pass filter, described in the answer to question 2D-8-2.6, will prevent harmonics of the desired signal from getting out.

2D-8-2.4 What is the purpose of shielding in a transmitter?

A. It gives the low pass filter structural stability
B. It enhances the microphonic tendencies of radiotelephone transmitters

C. It prevents unwanted RF radiation
D. It helps maintain a sufficiently high operating temperature in circuit components

The answer is C. Shielding the transmitter prevents the RF signals, spurious, or otherwise, from going anywhere except into the transmission line that feeds the antenna. If we then place a low pass filter between the transmitter and the transmission line, we will complete the suppression of unwanted radiation from the transmitter.

The various cabinets and housings that shield the transmitter and other station accessories, should be connected to a common ground point and then to a good ground to be effective.

2D-8-2.5 Your neighbor reports interference on one or two channels of her television when you are transmitting from your amateur station. This interference only occurs when you are operating on 15 meters. What is likely to be the cause of the interference?

A. Excessive low-pass filtering on the transmitter
B. Sporadic E de-ionization near your neighbor's TV antenna
C. TV Receiver front-end overload
D. Harmonic radiation from your transmitter

The answer is D. The chances are that the interference is caused by harmonic radiation from the transmitter. The most important step in eliminating this type of interference is to install a low pass filter at the transmitter. We should also shield the transmitter and ground all cabinets and accessory housings.

2D-8-2.6 What type of filter should be installed on an amateur transmitter as the first step in reducing harmonic radiation?

A. Key click filter
B. Low pass filter
C. High pass filter
D. CW filter

The answer is B. A low pass filter should be installed at the transmitter. It will reduce the transmission of harmonics. A low pass filter is a device made of coils and capacitors. It passes signals whose frequency is below a certain point, called the "cut-off" frequency. It prevents the passage of signals above the cut-off frequency. These signals, above the cut-off frequency, are the undesired harmonics.

2D-8-3.1 If you are notified that your amateur station is causing television interference, what should you do first?

A. Make sure that your amateur equipment is operating properly, and that it does not cause interference to your own television
B. Immediately turn off your transmitter and contact the nearest FCC office for assistance
C. Install a high-pass filter at the transmitter output and a low-pass filter at the antenna-input terminals of the TV

D. Continue operating normally, since you have no legal obligation to reduce or eliminate the interference

The answer is A. A low-pass filter should be installed at the output of your transmitter, and your equipment should be properly grounded and shielded.

2D-8-3.2 Your neighbor informs you that you are causing television interference, but you are sure your amateur equipment is operating properly and you cause no interference to your own TV. What should you do?

A. Immediately turn off your transmitter and contact the nearest FCC office for assistance
B. Work with your neighbor to determine that you are actually the cause of the interference
C. Install a high-pass filter at the transmitter output and a low-pass filter at the antenna-input terminals of the TV
D. Continue operating normally, since you have no legal obligation to reduce or eliminate the interference

The answer is B. If, after cooperating with your neighbor, you are 100% certain that your equipment is not the cause of the interference, you might suggest that they install a good quality high-pass filter and/or seek the services of a competent TV repairman. Do not, under any circumstances, try to repair your neighbor's set.

SUBELEMENT 2E
Electrical Principles
(4 Questions)

One question must be from the following:

2E-1-1.1 Your receiver dial is calibrated in megahertz and shows a signal at 1200 MHz. At what frequency would a dial calibrated in gigahertz show the signal?

A. 1,200,000 GHz
B. 12 GHz
C. 1.2 GHz
D. 0.0012 GHz

The answer is C. A gigahertz (GHz) is equal to 1 billion Hz or 1000 MHz. Therefore, in order to change megahertz to gigahertz, we divide by 1000. 1200 MHz ÷ 1000 = 1.2 GHz.

2E-1-2.1 Your receiver dial is calibrated in kilohertz and shows a signal at 7125 kHz. At what frequency would a dial calibrated in megahertz show the signal?

A. 0.007125 MHz B. 7.125 MHz C. 71.25 MHz D. 7,125,000 MHz

The answer is B. A megahertz (MHz) is equal to 1,000 kilohertz (kHz). Therefore, in order to change kilohertz to megahertz, we divide by 1,000. 7,125 kHz ÷ 1,000 = 7.125 MHz.

2E-1-2.2 Your receiver dial is calibrated in gigahertz and shows a signal at 1.2 GHz. At what frequency would a dial calibrated in megahertz show the same signal?

A.1.2 MHz B. 12 MHz C. 120 MHz D. 1200 MHz

The answer is D. See answer 2E-1-1.1. This problem is the opposite of the one in question 2E-1-1.1. In order to change gigahertz to megahertz, we multiply by 1,000. 1.2 GHz x 1,000 = 1,200 MHz.

2E-1-3.1 Your receiver dial is calibrated in megahertz and shows a signal at 3.525 MHz. At what frequency would a dial calibrated in kilohertz show the signal?

A. 0.003525 kHz B. 3525 kHz C. 35.25 kHz D. 3,525,000 kHz

The answer is B. A megahertz is equal to 1,000 kilohertz. Therefore, in order to change megahertz to kilohertz, we multiply by 1,000. 3.525 MHz x 1,000 = 3,525 kHz.

2E-1-3.2 Your receiver dial is calibrated in kilohertz and shows a signal at 3725 kHz. At what frequency would a dial calibrated in Hertz show the same signal?

A. 3,725 Hz B. 3.725 Hz C. 37.25 Hz D. 3,725,000 Hz

The answer is D. A kilohertz is equal to 1,000 hertz (Hz). Therefore, in order to change kilohertz to hertz, we multiply by 1,000. 3,725 kHz x 1,000 = 3,725,000 Hz.

2E-1-4.1 How long (in meters) is an antenna that is 400 centimeters long?

A. 0.0004 meters B. 4 meters C. 40 meters D. 40,000 meters

The answer is B. "centi" means one hundredth. There are 100 centimeters in a meter. In order to convert centimeters into meters, we divide by 100. 400 centimeters ÷ 100 = 4 meters.

2E-1-5.1 What reading will be displayed on a meter calibrated in amperes when it is being used to measure a 3000-milliampere current?

A. 0.003 amperes B. 0.3 amperes
C. 3 amperes D. 3,000,000 amperes

The answer is C. An ampere (A) is equal to 1,000 milliamperes (ma.). We change milliamperes to amperes by dividing the milliamperes by 1,000, or simply moving the decimal point three places to the left. 3,000 ma. ÷ 1,000 = 3 amperes.

2E-1-5.2 What reading will be displayed on a meter calibrated in volts when it is being used to measure a 3500-millivolt potential?

A. 350 volts B. 35 volts C. 3.5 volts D. .35 volts

The answer is C. One volt is equal to 1,000 millivolts. In order to convert millivolts to volts, we divide by 1,000. 3,500 millivolts ÷ 1,000 = 3.5 volts.

2E-1-6.1 How many farads is 500,000 microfarads?

A. 0.0005 farads B. 0.5 farads
C. 500 farads D. 500,000,000 farads

The answer is B. One farad is equal to one million microfarads. In order to change microfarads to farads, we divide the microfarads by 1,000,000, or simply move the decimal point six places to the left. 500,000 microfarads ÷ 1,000,000 = 0.5 farads.

2E-1-7.1 How many microfarads is 1,000,000 picofarads?

A. 0.001 microfarads
B. 1 microfarad
C. 1,000 microfarads
D. 1,000,000,000 microfarads

The answer is B. One microfarad is equal to 1,000,000 picofarads. In order to convert picofarads to microfarads, we divide the picofarads by 1,000,000, or simply move the decimal point six places to the left. 1,000,000 picofarads ÷ 1,000,000 = 1 microfarad.

One question must be from the following:

2E-2-1.1 What is the term used to describe the flow of electrons in an electric circuit?
A. Voltage B. Resistance C. Capacitance D. Current
The answer is D. Current is the flow of electrons through a wire or circuit. It occurs when voltage is applied to a circuit. The basic unit of current is the ampere.

2E-2-2.1 What is the basic unit of electric current?
A. The volt B. The watt C. The ampere D. The ohm
The answer is C. A milliampere is one thousandth of an ampere. A microampere is one millionth of an ampere.

2E-3-1.1 What supplies the force that will cause electrons to flow through a circuit?
A. Electromotive force, or voltage
B. Magnetomotive force, or inductance
C. Farad force, or capacitance
D. Thermodynamic force, or entropy
The answer is A. Electromotive force or voltage is the pressure that causes electrons to flow. Voltage is produced by a generator or battery.

2E-3-1.2 The pressure in a water pipe is comparable to what force in an electrical circuit?
A. Current B. Resistance C. Gravitation D. Voltage
The answer is D. The pressure in a water system pushes water in a manner similar to the voltage "pushing" electrons.

2E-3-1.3 An electric circuit must connect to two terminals of a voltage source. What are these two terminals called?
A. The north and south poles
B. The positive and neutral terminals
C. The positive and negative terminals
D. The entrance and exit terminals

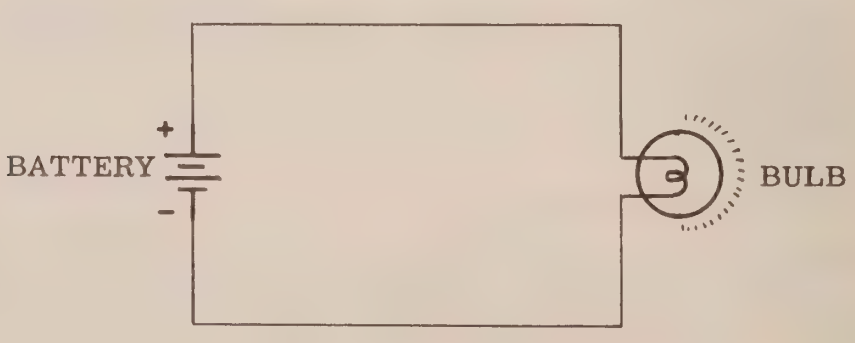


Fig. 2E-3-1.3. A battery hooked up to a bulb.

The answer is C. The question assumes that the voltage source is a DC source, such as a battery. This is shown in Figure 2E-3-1.3. The polarity of one terminal is positive and the polarity of the other terminal is negative.

2E-3-2.1 What is the basic unit of voltage?

A. The volt B. The watt C. The ampere D. The ohm

The answer is A. A kilovolt is one thousand volts. A millivolt is one thousandth of a volt. A microvolt is one millionth of a volt.

2E-4.1 List at least three good electrical conductors.

A. Copper, gold, mica B. Gold, silver, wood
C. Gold, silver, aluminum D. Copper, aluminum, paper

The answer is C. Copper is also an excellent conductor. Conductors allow current to flow through them easily.

2E-5.1 List at least four good electrical insulators.

A. Glass, air, plastic, porcelain B. Glass, wood, copper, porcelain
C. Paper, glass, air, aluminum D. Plastic, rubber, wood, carbon

The answer is A. Wood, silk and bakelite are other good electrical insulators. Insulators will not permit current to flow through them.

2E-6-1.1 There is a limit to the electric current that can pass through any material. What is this current limiting called?

A. Fusing B. Reactance C. Saturation D. Resistance

The answer is D. Resistance is the opposition that a part or circuit offers to current.

2E-6-1.2 What is an electrical component called that opposes electron movement through a circuit?

A. A resistor B. A reactor C. A fuse D. An oersted

The answer is A. All circuits and parts have some resistance in them. However, a resistor is a component with a specific amount of resistance.

2E-6-2.1 What is the basic unit of resistance?

A. The volt B. The watt C. The ampere D. The ohm

The answer is D. A megohm, which is equal to 1,000,000 ohms, is a commonly used unit of resistance.

One question must be from the following:

2E-7.1 What electrical principle relates voltage, current and resistance in an electric circuit?

A. Ampere's Law B. Kirchhoff's Law
C. Ohm's Law D. Tesla's Law

The answer is C. Ohm's Law gives the mathematical relationship between the resistance, the current and the voltage in a circuit. Ohm's Law states that the current is directly proportional to the voltage and is inversely proportional to the resistance. The three forms of Ohm's Law are:

$$\text{A) } I = \frac{E}{R} \qquad \text{B) } E = I \times R \qquad \text{C) } R = \frac{E}{I}$$

where: I is the current in amperes
E is the voltage in volts
R is the resistance in ohms

2E-7.2 There is a 2-amp current through a 50-ohm resistor. What is the applied voltage?

A. 0.04 volts B. 52 volts C. 100 volts D. 200 volts

The answer is C. We use formula B of the discussion of question 2E-7.1 in order to find the voltage when the current and resistance are known. $E = I \times R = 2 \times 50 = 100$ volts.

2E-7.3 If 200 volts is applied to a 100-ohm resistor, what is the current through the resistor?

A. 0.5 amps B. 2 amps C. 50 amps D. 20000 amps

The answer is B. We use formula A of the discussion of question 2E-7.1 in order to find the current when the voltage and resistance are known. $I = E \div R = 200 \div 100 = 2$ amperes.

2E-7.4 There is a 3-amp current through a resistor and we know that the applied voltage is 90 volts. What is the value of the resistor?

A. 0.03 ohms B. 10 ohms C. 30 ohms D. 2700 ohms

The answer is C. We use formula C of the discussion of question 2E-7.1 in order to find the resistance when the current and voltage are known. $R = E \div I = 90 \div 3 = 30$ ohms.

2E-8.1 What is the term used to describe the ability to do work?

A. Voltage B. Power C. Inertia D. Energy

The answer is D. Energy is defined as the ABILITY to do work. Energy can neither be created nor destroyed, but can be changed from one form to another. For instance, an electric motor changes electrical enery into mechanical energy.

2E-8.2 What is converted to heat and light in an electric light bulb?

A. Electrical energy B. Electrical voltage
C. Electrical power D. Electrical current

The answer is A. See answer 2E-8.1.

2E-9-1.1 What term is used to describe the rate of energy consump-

tion?

A. Energy B. Current C. Power D. Voltage

The answer is C. Power is defined as the RATE at which energy is transformed. Power is equal to the voltage multiplied by the current. The unit of power is the watt.

2E-9-1.2 You have two lamps with different wattage light bulbs in them. How can you determine which bulb uses electrical energy faster?

A. The bulb that operates from the higher voltage will consume energy faster

B. The physically larger bulb will consume energy faster

C. The bulb with the higher wattage rating will consume energy faster

D. The bulb with the lower wattage rating will consume energy faster

The answer is C. Since power is defined as the rate at which energy is transformed, the higher power (wattage) bulb will transform the energy faster.

2E-9-2.1 What is the basic unit of electrical power?

A. Ohm B. Watt C. Volt D. Ampere

The answer is B. A kilowatt is one thousand watts. A milliwatt is one thousandth of a watt.

2E-10.1 What is the term for an electrical circuit in which there can be no current?

A. A closed circuit B. A short circuit

C. An open circuit D. A hyper circuit

The answer is C. An open circuit indicates a break or opening in the circuit. Current cannot flow unless the circuit is complete. Figure 2E-10.1 illustrates an open circuit.

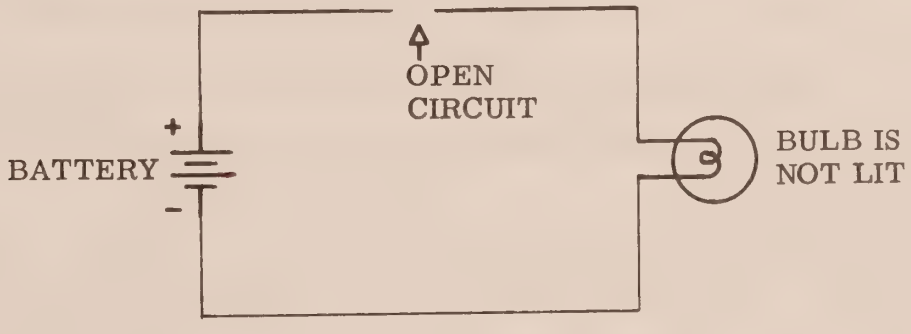


Fig. 2E-10.1. An open circuit.

2E-11.1 What is the term for a failure in an electrical circuit that causes excessively high current?

A. An open circuit B. A dead circuit

C. A closed circuit D. A short circuit

The answer is D. A short circuit presents very little resistance to a

voltage source, and causes a heavy, damaging current to flow. Figure 2E-11.1 illustrates a short circuit. Note that the current flows through the short and not through the bulb.

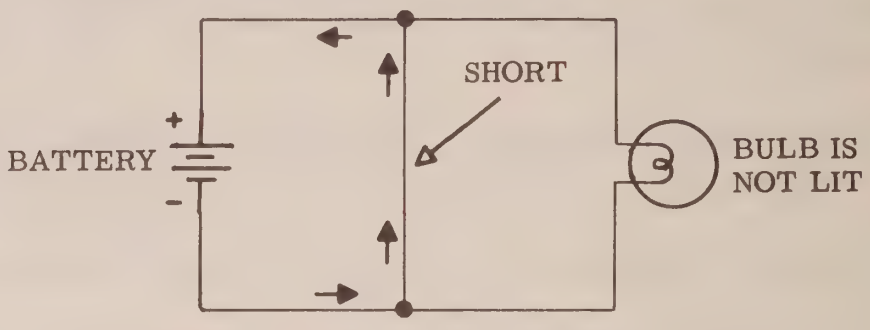


Figure. 2E-11.1. A short circuit.

One question must be from the following:

2E-12-1.1 What is the term used to describe a current that flows only in one direction?

A. Alternating current
B. Direct current
C. Periodic current
D. Pulsating current

The answer is B. Direct current flows in one direction only. A battery is a source of direct current. Figure 2E-12-1.1 shows the direction of current flow in a simple DC circuit.

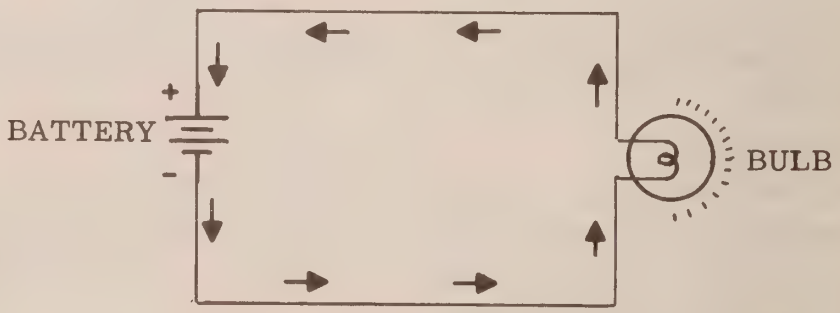


Fig. 2E-12-1.1. A circuit using a direct current source.

2E-12-2.1 What is the term used to describe a current that flows first in one direction, then in the opposite direction, over and over?

A. Alternating current
B. Direct current
C. Negative current
D. Positive current

The answer is A. Alternating current changes its direction of flow many, many times in one second. First it flows in one direction, then it reverses itself and flows in the other direction. The current in our homes is alternating current. It reverses itself 60 times per second.

2E-12-3.1 What is the term for the number of complete cycles of an alternating waveform that occur in one second?

A. Pulse repetition rate
B. Hertz
C. Frequency per wavelength
D. Frequency

The answer is D. Hertz is the unit of frequency. When we say that a signal is 60 Hertz (Hz), we mean that the signal makes 60 complete cycles in one second.

2E-12-3.2 A certain ac signal makes 2000 complete cycles in one second. What property of the signal does this number describe?
A. The frequency of the signal
B. The pulse repetition rate of the signal
C. The wavelength of the signal
D. The hertz per second of the signal
The answer is A. See answers 2E-12-2.1 and 2E-12-3.1.

2E-12-3.3 What is the basic unit of frequency?
A. The hertz B. The cycle C. The kilohertz D. The megahertz
The answer is A. See answers 2E-12-2.1 through 2E-12-3.2.

2E-12-4.1 What range of frequencies are usually called audio frequencies?
A. 0 to 20 Hz B. 20 to 20,000 Hz
C. 200 to 200,000 Hz D. 10,000 to 30,000 Hz
The answer is B. Audio frequencies refer to signals that can be heard by the human ear. When we convert electrical signals in the frequency range of 20 Hz - 20,000 Hz to sound signals, the human ear will hear them. Frequencies above and below this range cannot be detected by the human ear.

2E-12-4.2 A signal at 725 Hz is in what frequency range?
A. Audio frequency B. Intermediate frequency
C. Microwave frequency D. Radio Frequency
The answer is A. See answer 2E-12-4.1.

2E-12-4.3 Why do we call signals in the range 20 Hz to 20,000 Hz audio frequencies?
A. Because the human ear rejects signals in this frequency range
B. Because the human ear responds to sounds in this frequency range
C. Because frequencies in this range are too low for a radio to detect
D. Because a radio converts signals in this range directly to sounds the human ear responds to
The answer is B. See answer 2E-12-4.1.

2E-12-5.1 Signals above what frequency are usually called radio-frequency signals?
A. 20 Hz B. 2000 Hz C. 20,000 Hz D. 1,000,000 Hz
The answer is C. See answer 2E-12-4.1.

2E-12-5.2 A signal at 7125 kHz is in what frequency range?

A. Audio frequency
B. Radio frequency
C. Hyper-frequency
D. Super-high frequency

The answer is B. 7125 kHz is higher than 20,000Hz.

2E-13.1 What is the term for the distance an ac signal travels during one complete cycle?

A. Wave velocity
B. Velocity factor
C. Wavelength
D. Wavelength per meter

The answer is C. An AC signal has a certain wavelength which is defined as the distance between adjacent peaks of the signal. It is the distance that the signal travels through space during one cycle.

2E-13.2 In the time it takes a certain radio signal to pass your antenna, the leading edge of the wave travels 12 meters. What property of the signal does this number refer to?

A. The signal frequency
B. The wave velocity
C. The velocity factor
D. The signal wavelength

The answer is D. See answer 2E-13.1.

SUBELEMENT 2F
Circuit Components
(2 Questions)

One question must be from the following:

2F-1.1 What is the symbol used on schematic diagrams to represent a resistor?

A.

B.

C.

D.

The answer is B. Do not confuse the resistor with the coil of answer D. The resistor has straight lines in a "sawtooth" pattern. The coil has curved lines.

2F-1.2 What is the symbol used on schematic diagrams to represent a variable resistor or potentiometer?

A.

B.

C.

D.

The answer is C. The arrow through the resistor indicates that it is variable. B is a variable coil, D is a variable capacitor and A is a light-emitting diode.

2F-1.3 In diagram 2F-1, which component is a resistor?

A. 1
B. 2
C. 3
D. 4

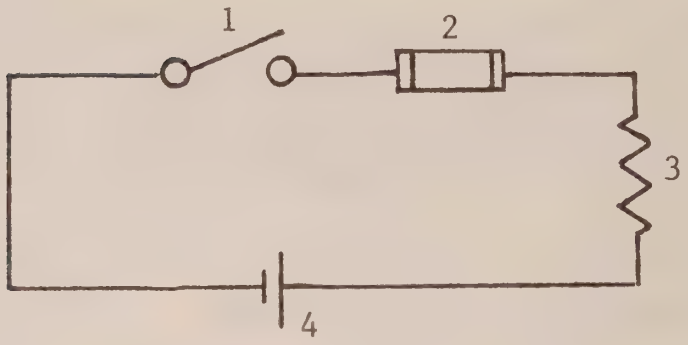


Figure 2F-1 (2F-2).

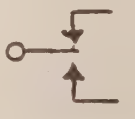
The answer is C. See answer 2F-1.1.

2F-2.1 What is the symbol used on schematic diagrams to represent a single-pole, single-throw switch?

A.

B.

C.

D. 

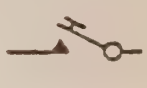
The answer is A. The term "single-pole, single-throw" means that a single circuit or line can either be closed or open. There are just two contacts that are either touching each other or not touching each other.

2F-2.2 What is the symbol used on schematic diagrams to represent a single-pole, double-throw switch?

A.

B.

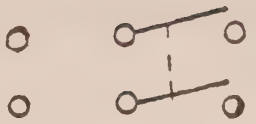
C.

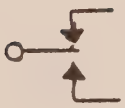
D. 

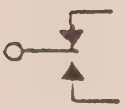
The answer is A. The term "single-pole, double-throw" means that a single pole or terminal can make contact with either of two other contacts.

2F-2.3 What is the symbol used on schematic diagrams to represent a double-pole, double-throw switch?

A.

B. 

C. 

D. 

The answer is B. The center terminals to which the two poles are attached, can make contact with either the two terminals on the right or the two terminals on the left. Figure 2F-2.3 shows another way of drawing a double-pole, double-throw switch.

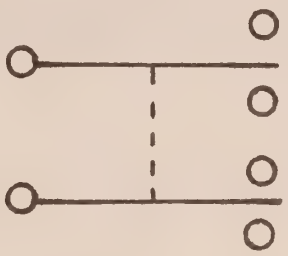
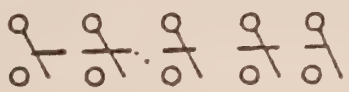
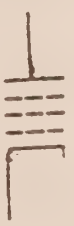


Figure 2F-2.3. A double-pole, double-throw switch

2F-2.4 What is the symbol used on schematic diagrams to represent a single pole 5-position switch?

A. 

B. 

C.

D.

The answer is D. The single pole can make contact between the center, lower terminal and any one of the five upper terminals (or "positions").

2F-2.5 In diagram 2F-2 (See question 2F-1.3), which component is a switch?

A. 1
B. 2
C. 3
D. 4

The answer is A. This is a single-pole, single-throw switch, similar to the one in answer 2F-2.1.

2F-3.1 What is the symbol used on schematic diagrams to represent a fuse?

A.

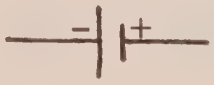
B.

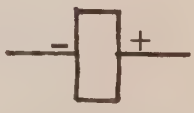
C.

D.

The answer is C. A fuse is a device that is used to protect a circuit from damage due to excessive current. The fuse has a fixed maximum current-carrying capacity. It is placed in series with the circuit that it is to protect. When the maximum current capacity of the fuse is exceeded, it burns up and opens the circuit. This protects the equipment from damage.

2F-4.1 What is the symbol used on schematic diagrams to represent a single-cell battery?

A. 

B. 

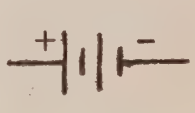
C.

D.

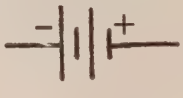
The answer is C. The short line is the negative terminal and the long line is the positive terminal. Answer A shows a single dry cell, but the markings are wrong.

2F-4.2 What is the symbol used on schematic diagrams to represent a multiple-cell battery?

A.

B. 

C.

D. 

The answer is B. Answer D. shows a battery, but the markings are wrong.

One question must be from the following:

2F-5.1 What is the symbol normally used to represent an earth-ground connection on schematic diagrams?

A.

B.

C.

D.

The answer is D. Answer B is also ground, but it represents the chassis ground (metal ground of the equipment) rather than the earth.

2F-5.2 What is the symbol normally used to represent a chassis-ground connection on schematic diagrams?

A.

B.

C.

D.

The answer is B. See answer 2F-5.1.

2F-5.3 In diagram 2F-5 (2F-7), which symbol represents a chassis ground connection?

A. 1 B. 2 C. 3 D. 4

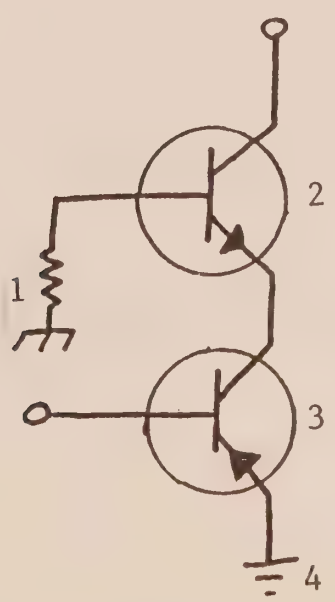


Figure 2F-5 (2F-7).

. The answer is A. The chassis ground connection goes to the resistor.

2F-5.4 In diagram 2F-5 (2F-7), which symbol represents an earth ground connection?

A. 1 B. 2 C. 3 D. 4

The answer is D. The earth ground goes to the emitter of the transistor.

2F-6.1 What is the symbol used to represent an antenna on schematic diagrams?

A.

B.

C.

D.

The answer is D.

2F-7.1 What is the symbol used to represent an NPN bipolar transistor on schematic diagrams?

A.

B.

C.

D.

The answer is C. B stands for Base, which is similar to the grid of a tube. C stands for Collector, which is similar to the plate of a tube. E stands for Emitter, which is similar to the cathode of a tube. See answer 2F-7.2.

2F-7.2 What is the symbol used to represent a PNP bipolar transistor on schematic diagrams?

A.

B.

C.

D.

The answer is A. The schematic difference between the NPN and PNP transistors is the direction of the arrow on the emitter.

2F-7.3 In diagram 2F-7 (See Question 2F-5.3), which symbol represents a PNP bipolar transistor?

A. 1 B. 2 C. 3 D. 4

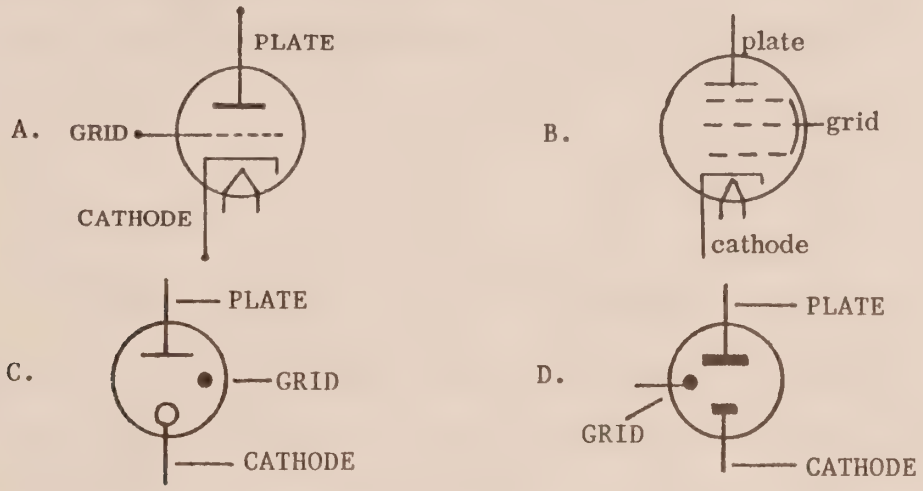
The answer is C. See answer 2F-7.2.

2F-7.4 In diagram 2F-7 (See Question 2F-5.3), which symbol represents an NPN bipolar transistor?

A. 1 B. 2 C. 3 D. 4

The answer is B. See answers 2F-7.1 and 2F-7.2.

2F-8.1 What is the symbol used to represent a triode vacuum tube on schematic diagrams?

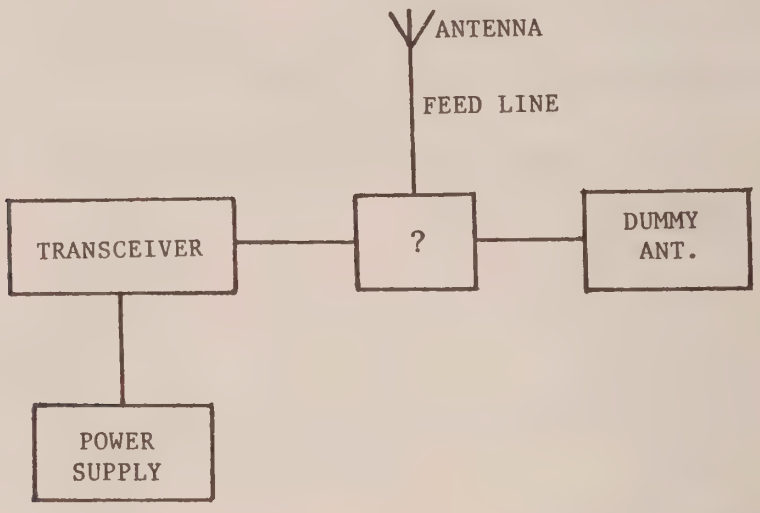


The answer is A. We refer to this tube as a triode because it has three basic elements. The filament, which is located below the cathode in the diagram, is not considered an element when there is a cathode. It is the heater for the cathode.

SUBELEMENT 2G
Practical Circuits
(2 Questions)

One question must be from the following:

2G-1-1.1 What is the unlabeled block (?) in this diagram?



A. A terminal-node controller
B. An antenna switch
C. A telegraph key
D. A TR switch

The answer is B. The antenna switch allows the operator to switch the transceiver output between the antenna and the dummy load. In actual practice, we can tune up the transceiver using the dummy load; then, we switch over to the antenna.

2G-1-1.2 What is the unlabeled block (?) in this diagram?

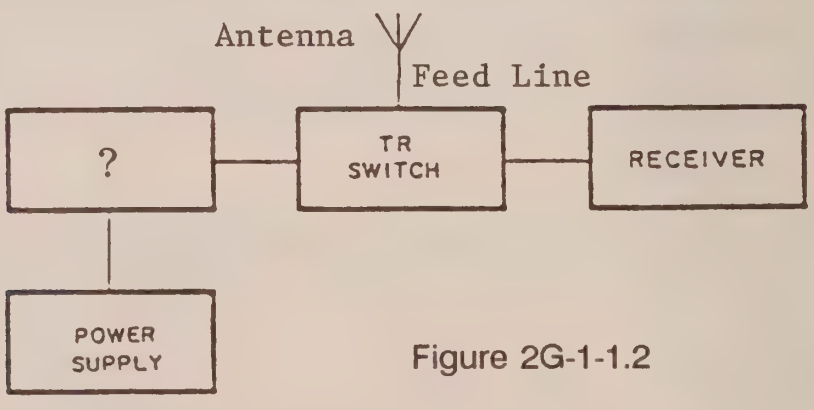
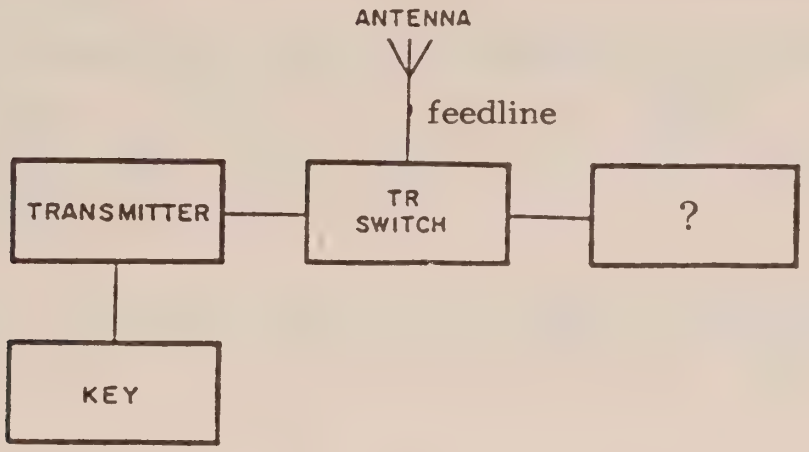


Figure 2G-1-1.2

A. A microphone
B. A receiver
C. A transmitter
D. An SWR meter

The answer is C. Figure 2G-1-1.2 is a simplified block diagram of a complete station. The TR (Transmit-Receive) switch transfers the common antenna from the transmitter to the receiver and vice versa.

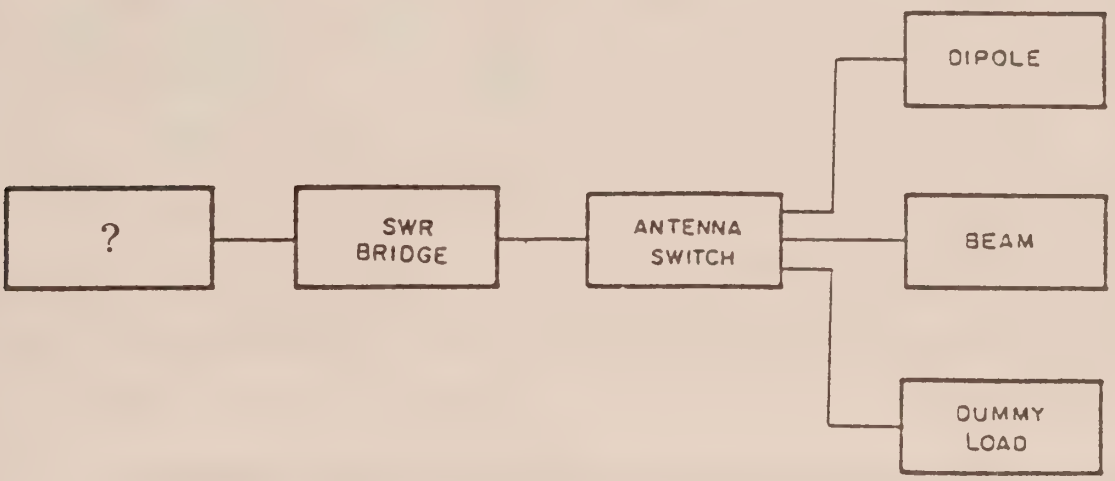
2G-1-1.3 What is the unlabeled block (?) in this diagram?



A. A key click filter
B. An antenna tuner
C. A power supply
D. A receiver

The answer is D. See answer 2G-1-1.2.

2G-1-1.4 What is the unlabeled block (?) in this diagram?



A. A transceiver
B. A TR switch
C. An antenna tuner
D. A modem

The answer is A. A transceiver is a combination of a TRANSmitter and a reCEIVER in one unit. The antenna switch chooses between the dipole antenna, the beam antenna and the dummy load. A station need not have two antennas as shown above.

2G-1-1.5 In block diagram 2G-1, which symbol represents an antenna?

A. 1 B. 2 C. 3 D. 4

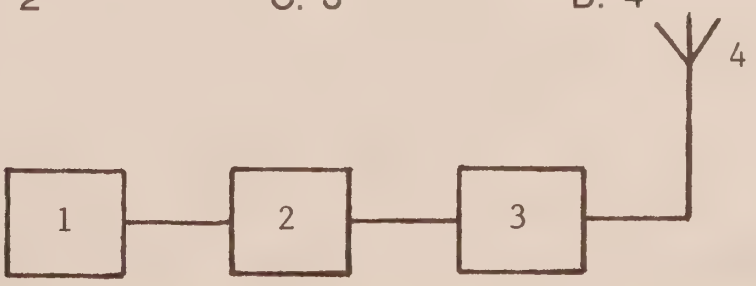


Figure 2G-1.

The answer is D. Blocks 1, 2 and 3 represent stages of equipment.

2G-1-2.1 What is the unlabeled block (?) in this diagram?

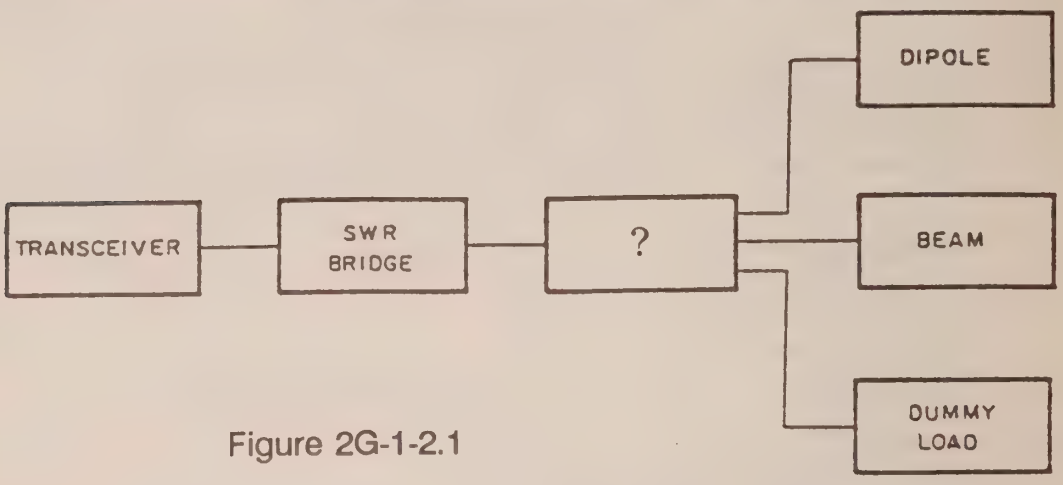


Figure 2G-1-2.1

A. A pi network
B. An antenna switch
C. A key click filter
D. A mixer

The answer is B. This diagram illustrates how a transceiver can be switched to either one of two antennas or a dummy load. The unlabeled block is the antenna switch. It is a simple three-way switch that allows the transceiver to be connected to one of the three blocks. The block labeled "dipole" is a simple type of half-wave dipole antenna. The block labeled "beam" is a more complex antenna that concentrates the RF energy radiated from the antenna into a narrow "beam" of energy. The box, labeled "dummy load", absorbs the RF output of the transmitter without radiating it. The dummy load is used when testing or tuning up the transmitter.

2G-1-2.2 What is the unlabeled block (?) in this diagram?

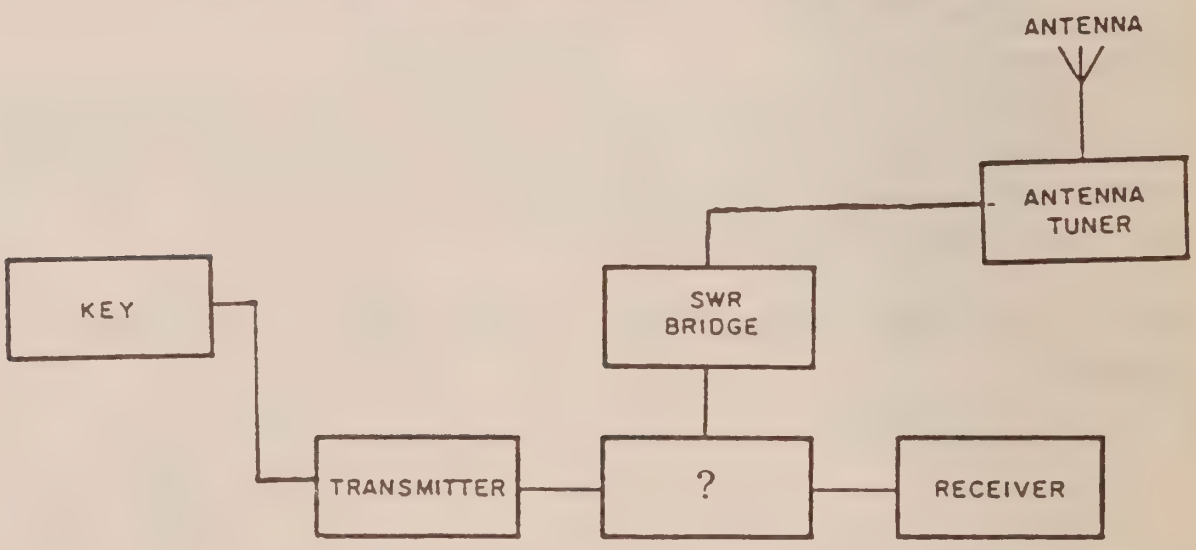


Figure 2G-1-2.2.

A. A TR switch

B. A variable frequency oscillator
C. A linear amplifier
D. A microphone

The answer is A. Figure 2G-1-2.2 is a block diagram of a complete amateur station. The unlabeled block is the Transmit-Receive antenna switch. It switches the antenna, tuner and SWR bridge from the receiver to the transmitter and back.

2G-1-2.3 What is the unlabeled block (?) in this diagram?

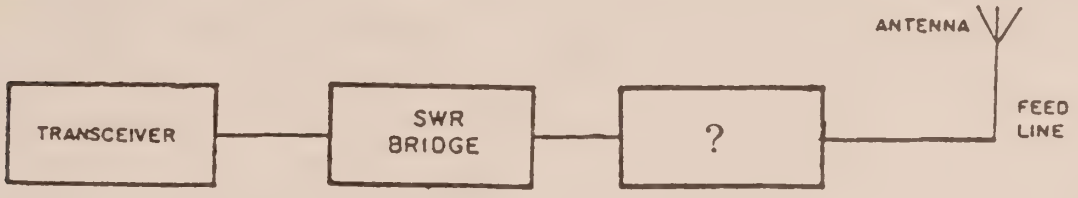


Figure 2G-1-2.3.

A. An antenna switch
B. An impedance-matching network
C. A key click filter
D. A terminal-node controller

The answer is B. An impedance matching device is placed between the equipment and the antenna feed line. Its purpose is to insure maximum transfer of power from the transmitter to the antenna. Maximum power is transferred between two points if the impedances of the two points are equal. If they are not equal, an impedance-matching device is used to effect maximum transfer.

2G-1-2.4 In block diagram 2G-1 (See Question 2G-1-1.5), if component 1 is a transceiver and component 2 is an SWR meter, what is component 3?

A. A power supply
B. A receiver
C. A microphone
D. An impedance matching device

The answer is D. See answer 2G-1-2.3.

2G-1-2.5 In block diagram 2G-1 (See Question 2G-1-1.5), if component 2 is an SWR meter and component 3 is an impedance matching device, what is component 1?

A. A power supply
B. An antenna
C. An antenna switch
D. A transceiver

The answer is D. See questions 2G-1-2.3 and 2G-1-2.4.

One question must be from the following:

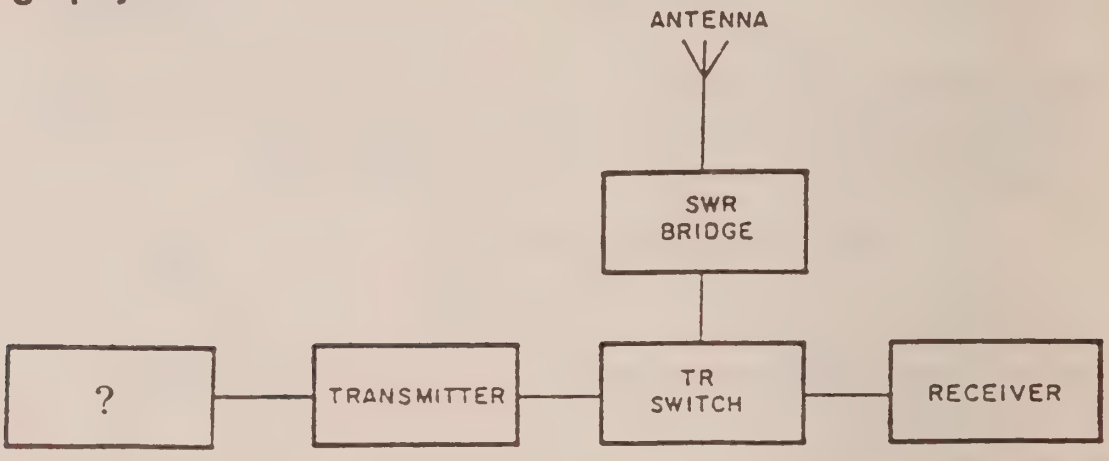
2G-2.1 In an amateur station designed for Morse radiotelegraph

operation, what station accessory will you need to go with your transmitter?

A. A terminal-node controller
B. A telegraph key
C. An SWR meter
D. An antenna switch

The answer is B. An SWR meter and antenna switch are also station accessories for a CW transmitter, but they aren't essential. However, a radiotelegraph transmitter cannot function without a telegraph key.

2G-2.2 What is the unlabeled block (?) in this diagram of a Morse telegraphy station?



A. A sidetone oscillator
B. A microphone
C. A telegraph key
D. A DTMF keypad

The answer is C. See answer 2G-2.1.

2G-2.3 What station accessory do many amateurs use to help form good Morse code characters?

A. A sidetone oscillator
B. A key-click filter
C. An electronic keyer
D. A DTMF keypad

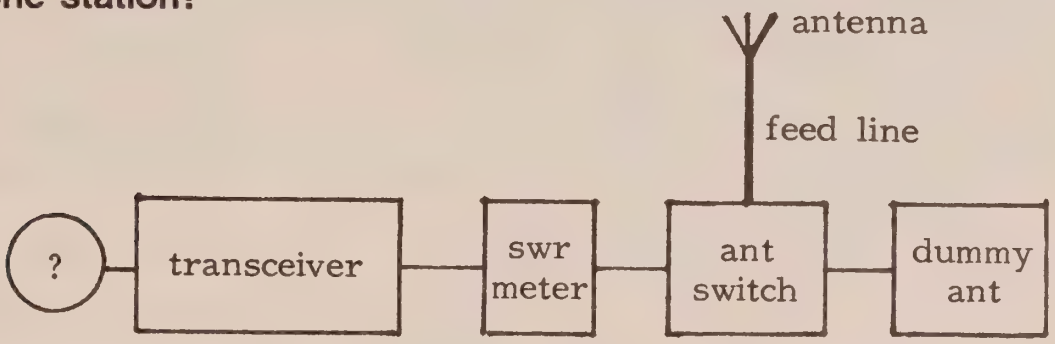
The answer is C. It is important for a beginner to learn to use a simple straight key properly. As his speed and experience improve, he may be interested in a keyer. A keyer is a device that automatically produces perfect dots and dashes at the correct speed. It can be used to send perfect code at speeds up to 50 - 60 words per minute. In a basic keyer, a string of dots are automatically produced when a small keying paddle is moved to one side. A string of dashes are produced when the paddle is moved to the other side.

2G-3.1 In an amateur station designed for radiotelephone operation, what station accessory will you need to go with your transmitter?

A. A splatter filter
B. A terminal-voice controller
C. A receiver audio filter
D. A microphone

The answer is D. The microphone is the device that transforms sound waves into electrical signals. These audio electrical signals are then fed to an audio amplifier in the transmitter.

2G-3.2 What is the unlabeled block (?) in this diagram of a radiotelephone station?



A. A splatter filter
B. A terminal-voice controller
C. A receiver audio filter
D. A microphone

The answer is D. See answer 2G-3.1.

2G-4.1 In an amateur station designed for radioteletype operation, what station accessories will you need to go with your transmitter?

A. A modem and a teleprinter or computer system
B. A computer, a printer and a RTTY refresh unit
C. A terminal-node controller
D. A modem, a monitor and a DTMF keypad

The answer is A. Radioteletype (abbreviated RTTY) is a system in which one types out information with a device that is similar to a typewriter. This typewriter device changes the letters of the alphabet into electrical signals. These electrical signals are used to modulate a carrier, which is then transmitted. At the receiving end, a receiver picks up and amplifies the signal. The signal is then fed to a demodulator, which extracts the information and changes it into a form which activates the keys of a typewriter and prints out the original information.

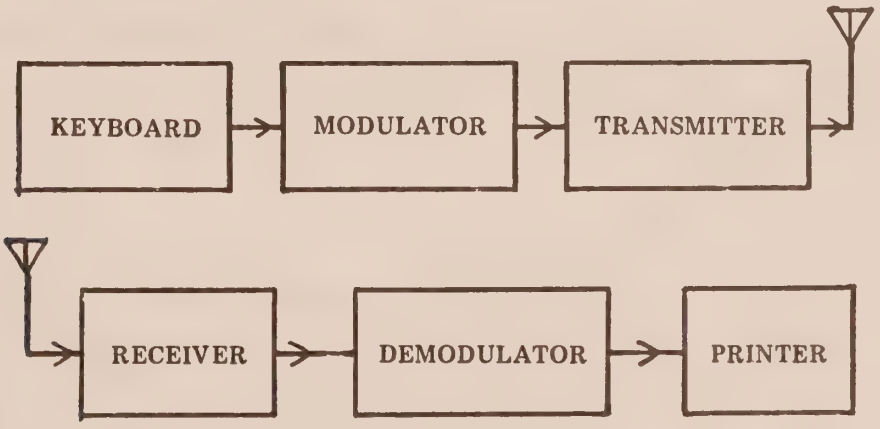


Fig. 2G-4.1. A basic radioteletype system

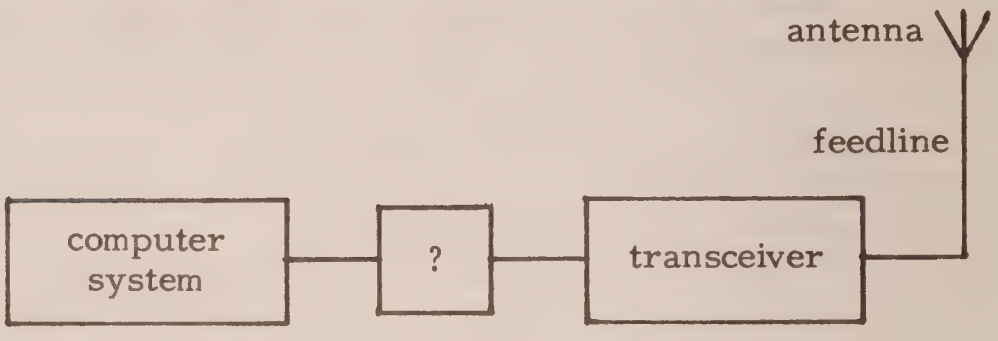
Figure 2G-4.1 illustrates a simplified block diagram of a complete teletype system. The keyboard is the typewriter device that generates combinations of pulses. Each combination represents a different letter of the alphabet. The modulator converts the pulses into different frequency

tones. These tones then modulate the transmitter.

At the receiving end, the receiver changes the radio signals into tones, which are then applied to the demodulator. The demodulator is also called a detector, a converter, or a terminal unit. The demodulator converts the tones into corresponding pulses. The pulses are applied to the printer, which responds by printing a different letter of the alphabet for each different combination of pulses.

In a modern system, the transmitter and receiver can be housed in one unit, called a transceiver (XCVR). The modulator and demodulator can be housed in one unit called a modem (modem is the contraction of the terms modulator and demodulator). The keyboard and printer are part of the teleprinter or computer system.

2G-4.2 What is the unlabeled block (?) in this diagram?



A. An RS-232 interface
B. SWR bridge
C. Modem
D. Terminal-network controller

The answer is C. See answer 2G-4.1.

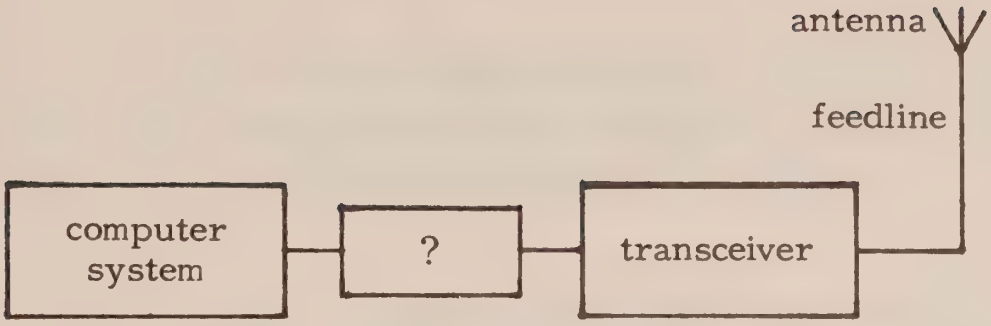
2G-5.1 In a packet-radio station, what device connects between the radio transceiver and the computer terminal?

A. A terminal-node controller
B. An RS-232 interface
C. A terminal refresh unit
D. A tactical network control system

The answer is A. The Terminal Node Controller (TNC) is the heart of the packet-radio system. It is in the TNC where the information to be transmitted is assembled, packaged and addressed. The "packets" are then passed on to be transmitted. The TNC also receives packets and extracts information from them.

2G-5.2 What is the unlabeled block (?) in this diagram of a packet-radio station?

A. A terminal-node controller
B. An RS-232 interface



C. A terminal refresh unit
D. A tactical network control system
The answer is A. See answer 2G-5.1.

2G-5.3 Where does a terminal-node controller connect in an amateur packet-radio station?
A. Between the antenna and the radio
B. Between the computer and the monitor
C. Between the computer or terminal and the radio
D. Between the keyboard and the computer
The answer is C. See answers 2G-5.1 and 2G-5.2.

SUBELEMENT 2H
Signals and Emissions
(2 Questions)

One question must be from the following:

2H-1-1.1 What keying method is used to transmit CW?
A. Frequency-shift keying of a radio-frequency signal
B. On/off keying of a radio-frequency signal
C. Audio-frequency-shift keying of an oscillator tone
D. On/off keying of an audio-frequency signal
The answer is B. See the Table of Emissions in Appendix 1 and the Emission definitions in Appendix 2.

2H-1-1.2 What emission type describes international Morse code telegraphy messages?
A. RTTY B. Image C. CW D. Phone
The answer is C. See the Table of Emissions in Appendix 1 and the Emission definitions in Appendix 2.

2H-1-2.1 What emission type describes narrow-band direct-printing telegraphy emissions?
A. RTTY B. Image C. CW D. Phone
The answer is A. See the Table of Emissions in Appendix 1 and the Emission definitions in Appendix 2.

2H-1-2.2 What keying method is used to transmit RTTY messages?
A. Frequency-shift keying of a radio-frequency signal
B. On/off keying of a radio-frequency signal
C. Digital pulse-code keying of an unmodulated carrier
D. On/off keying of an audio-frequency signal
The answer is A. In frequency shift keying (abbreviated FSK), we take a CW signal that is "on" all the time and vary it between two frequencies. The difference between the two frequencies (frequency shifting) is usually 170 Hz. This frequency shift must be absolutely constant so that the selective filters in the receiving converter can respond properly. Frequency shift keying is used below 50 MHz (HF bands).

2H-1-3.1 What emission type describes frequency-modulated voice transmissions?
A. FM phone B. Image
C. CW D. Single-sideband phone

The answer is A. See the Table of Emissions in Appendix 1 and the Emission definitions in Appendix 2. In a frequency modulated system, the carrier amplitude remains constant and its frequency varies. This is in contrast with an AM system where the carrier frequency is constant and the carrier's amplitude varies.

2H-1-4.1 What emission designator describes single-sideband suppressed-carrier (SSB) voice transmissions?

A. FM phone B. Image C. CW D. Sideband phone

The answer is D. See the Table of Emissions in Appendix 1 and the Emission definitions in Appendix 2. Single sideband, suppressed carrier voice signals occupy half the bandwidth that AM signals occupy. Also, SSB signals require far less power than AM signals for transmitting a certain amount of information.

2H-2.1 What does the term key click mean?

A. The mechanical noise caused by closing a straight key too hard
B. The clicking noise from an excessively square CW keyed waveform
C. The sound produced in a receiver from a CW signal faster than 20 WPM
D. The sound of a CW signal being copied on an AM receiver

The answer is B. Key clicks are the loud "clicks" or "thumps" that occur at the beginning and/or end of each dot and dash. They are due to the fact that large amounts of power are suddenly applied and removed from a circuit when a transmitter is keyed. See the answer to Question 2H-2.2.

2H-2.2 How can key clicks be eliminated?

A. By reducing your keying speed to less than 20 WPM
B. By increasing power to the maximum allowable level
C. By using a power supply with better regulation
D. By using a key-click filter

The answer is D. Figure 2H-2.2 illustrates the circuit of a key-click filter. Inductance, L, causes a slight lag in current and prevents the sudden current build-up when the key is closed. The combination of C and R absorb the sparks that occur across the key when it is opened and closed. Sparks cause the generation of sidebands which produce clicks in receivers, even though they are not tuned to the same frequency as the offending transmitter.

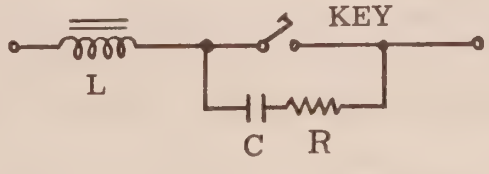


Figure 2H-2.2. A key-click filter.

2H-3.1 What does the term chirp mean?
A. A distortion in the receiver audio circuits
B. A high-pitched audio tone transmitted with a CW signal
C. A slight shift in oscillator frequency each time a CW transmitter is keyed
D. A slow change in transmitter frequency as the circuit warms up

The answer is C. A "chirp" occurs when the tone of the dot or dash changes. The changing tone sounds like a chirp. Chirping is due to a changing oscillator frequency when the key is depressed. A changing oscillator frequency is due to a change in voltage on the elements of the oscillator's tube or transistor.

2H-3.2 What can be done to the power supply of a CW transmitter to avoid chirp?
A. Resonate the power supply filters
B. Regulate the power supply output voltages
C. Use a buffer amplifier between the transmitter output and the feed line
D. Hold the power supply current to a fixed value

The answer is B. The regulation of the power supply (its ability to maintain a constant output voltage, regardless of load current changes) should be improved. This will cause the output voltage of the power supply, which is applied to the oscillator stage, to remain constant when the key is depressed and thereby eliminate chirp.

2H-4.1 What is a common cause of superimposed hum?
A. Using a nonresonant random-wire antenna
B. Sympathetic vibrations from a nearby transmitter
C. Improper neutralization of the transmitter output stage
D. A defective filter capacitor in the power supply

The answer is D. Replacing the defective capacitor will remove the hum from the signal.

2H-4.2 What type of problem can a bad power-supply filter capacitor cause in a transmitter or receiver?
A. Sympathetic vibrations in nearby receivers
B. A superimposed hum or buzzing sound
C. Extreme changes in antenna resonance
D. Imbalance in the mixers

The answer is B. The purpose of the power-supply filter is to remove the AC hum component from the DC that feeds the tubes or transistors in the equipment. If the filter capacitor is defective, the hum will be heard in the speaker.

One question must be from the following:

2H-5.1 What is the 4th harmonic of a 7160-kHz signal?

A. 28,640 kHz
B. 35,800 kHz
C. 28,160 kHz
D. 1790 kHz

The answer is A. A harmonic is a multiple of a fundamental signal. In order to find the 4th harmonic of 7160-kHz, we simply multiply by 4.

7160 kHz x 4 = 28,640 kHz.

2H-5.2 You receive an FCC Notice of Violation stating that your station was heard on 21,375 kHz. At the time listed on the notice, you were operating on 7125 kHz. What is a possible cause of this violation?

A. Your transmitter has a defective power-supply filter capacitor
B. Your CW keying speed was excessively fast
C. Your transmitter was radiating excess harmonic signals
D. Your transmitter has a defective power-supply filter choke

The answer is C. 21,375 kHz is the third harmonic of 7125 kHz (7125 x 3 = 21,375). Interference at this frequency indicates excessive harmonic radiation.

2H-6.1 What may happen to body tissues that are exposed to large amounts of UHF or microwave RF energy?

A. The tissue may be damaged because of the heat produced
B. The tissue may suddenly be frozen
C. The tissue may be immediately destroyed because of the Maxwell Effect
D. The tissue may become less resistant to cosmic radiation

The answer is A. Exposure to large amounts of RF, especially VHF and UHF, will cause tissue damage. See answer 2D-4.2.

2H-6.2 What precaution should you take before working near a high-gain UHF or microwave antenna (such as a parabolic, or dish antenna)?

A. Be certain the antenna is FCC type accepted
B. Be certain the antenna and transmitter are properly grounded
C. Be certain the transmitter cannot be operated
D. Be certain the antenna safety interlocks are in place

The answer is C. See answer 2D-4.2.

2H-6.3 You are installing a VHF or UHF mobile radio in your vehicle. What is the best location to mount the antenna on the vehicle to minimize any danger from RF exposure to the driver or passengers?

A. In the middle of the roof
B. Along the top of the windshield
C. On either front fender

D. On the trunk lid

The answer is A. The metal top of the car acts as a shield, preventing the RF output of the antenna from getting into the car. If the antenna was mounted on the back or side, RF would get into the car from the back or side windows.

2H-7.1 You discover that your tube-type transmitter power amplifier is radiating spurious emissions. What is the most likely cause of this problem?

A. Excessively fast keying speed
B. Undermodulation
C. Improper neutralization
D. Tank-circuit current dip at resonance

The answer is C. An RF stage is neutralized in order to prevent it from oscillating and emitting spurious signals. It oscillates because of the feedback from the plate circuit to the grid circuit, through the plate-grid capacitance of the tube. When the RF stage is designed, it is neutralized by adding a small capacitor in such a way that it neutralizes or cancels out the existing interelectrode capacity, thereby preventing the stage from oscillating.

2H-7.2 Your transmitter radiates signals outside the amateur band where you are transmitting. What term describes this radiation?

A. Off-frequency emissions
B. Transmitter chirp
C. Incidental radiation
D. Spurious emissions

The answer is D. Spurious emissions can be defined as "signals radiated from a transmitter on frequencies other than the desired frequency".

2H-7.3 What problem can occur if you operate your transmitter without the cover and other shielding in place?

A. Your transmitter can radiate spurious emissions
B. Your transmitter may radiate a "chirpy" signal
C. The final amplifier efficiency of your transmitter may decrease
D. You may cause splatter interference to other stations operating on nearby frequencies

The answer is A. There are various harmonics and other spurious signals present inside of the transmitter. A completely enclosed metal case and proper shielding will keep these spurious emissions confined inside the transmitter case. Only the desired signal will be present at the output of the transmitter.

2H-7.4 What type of interference will you cause if you operate your

SSB transmitter with the microphone gain adjusted too high?

A. You may cause digital interference to computer equipment in your neighborhood
B. You may cause splatter interference to other stations operating on nearby frequencies
C. You may cause atmospheric interference in the air around your antenna
D. You may cause processor interference to the microprocessor in your rig

The answer is B. Splatter is a term used to describe severe distortion and adjacent channel interference. Proper adjustment of the microphone gain control prevents this distortion by automatically limiting the gain of prior stages. However, the audio gain should be high enough for proper modulation.

2H-7.5 What may happen if you adjust the microphone gain or deviation control on your FM transmitter too high?

A. You may cause digital interference to computer equipment in your neighborhood
B. You may cause interference to other stations operating on nearby frequencies
C. You may cause atmospheric interference in the air around your antenna
D. You may cause processor interference to the microprocessor in your rig

The answer is B. By limiting the audio gain, we prevent excessive deviation with its subsequent interference to adjacent frequencies. On the other hand, the audio should be strong enough to provide reasonable deviation which produces a strong FM signal.

2H-7.6 What type of interference can excessive amounts of speech processing in your SSB transmitter cause?

A. You may cause digital interference to computer equipment in your neighborhood
B. You may cause splatter interference to other stations operating on nearby frequencies
C. You may cause atmospheric interference in the air around your antenna
D. You may cause processor interference to the microprocessor in your rig

The answer is B. See answer 2H-7.4.

SUBELEMENT 2I
Antennas and Feedlines
(3 Questions)

One question must be from the following:

2I-1.1 What is the approximate length (in feet) of a half- wavelength dipole antenna for 3725 kHz?

A. 126 ft ← B. 81 ft C. 63 ft D. 40 ft

The answer is A. A reasonably accurate formula for finding the length of a half-wave antenna where the frequency is known, is:

$L = \frac{468}{f}$ where: L is the antenna length in feet, and f is the frequency in MHz. If the frequency is given in kiloHertz (kHz), we must change it to MegaHertz (MHz) before substituting in the formula.

We solve the above problem as follows: We change kHz to MHz by dividing the kHz by 1,000.

$$\frac{3{,}725 \text{ kHz}}{1{,}000} = 3.725 \text{ MHz}$$

We then substitute 3.725 for f in the formula:

$$L = \frac{468}{3.725} = 125.64 \text{ feet}$$

2I-1.2 What is the approximate length (in feet) of a half- wavelength dipole antenna for 7125 kHz?

A. 84 ft B. 42 ft C. 33 ft D. 66 ft ←

The answer is D. We find the antenna length by using the method given in answer 2I-1.1.

$$\frac{7{,}125 \text{ kHz}}{1{,}000} = 7.125 \text{ MHz} \qquad L = \frac{468}{7.125} = 65.68 \text{ feet}$$

2I-1.3 What is the approximate length (in feet) of a half- wavelength dipole antenna for 21,125 kHz?

A. 44 ft B. 28 ft C. 22 ft D. 14 ft

The answer is C. We find the antenna length using the method given in answer 2I-1.1.

$$\frac{21{,}125 \text{ kHz}}{1{,}000} = 21.125 \text{ MHz} \qquad L = \frac{468}{21.125} = 22.15 \text{ feet}$$

2I-1.4 What is the approximate length (in feet) of a half- wavelength dipole antenna for 28,150 kHz?

A. 22 ft B. 11 ft C. 17 ft D. 34 ft

The answer is C. We find the antenna length using the method given in answer 2I-1.1.

$$\frac{28{,}150 \text{ kHz}}{1{,}000} = 28.150 \qquad L = \frac{468}{28.15} = 16.63 \text{ feet}$$

2I-1.5 How is the approximate length (in feet) of a half- wavelength dipole antenna calculated?

A. By substituting the desired operating frequency for f in the formula: $\frac{150}{f \text{ (in MHz)}}$

B. By substituting the desired operating frequency for f in the formula: $\frac{234}{f \text{ (in MHz)}}$

C. By substituting the desired operating frequency for f in the formula: $\frac{300}{f \text{ (in MHz)}}$

D. By substituting the desired operating frequency for f in the formula: $\frac{468}{f \text{ (in MHz)}}$

The answer is D. See answer 2I-1.1.

2I-2.1 What is the approximate length (in feet) of a quarter- wavelength vertical antenna for 3725 kHz?

A. 20 ft B. 32 ft C. 40 ft D. 63 ft

The answer is D. This question is similar to question 2I-1.1, except that we are looking for the length of a quarter-wave instead of a half-wave antenna. Since a quarter-wave antenna is one half of a half-wave antenna, we can use the same formula, and then divide the answer by 2.

The length of a quarter-wave antenna for 3,725 kHz would therefore be half of that given in the answer to question 2I-1.1, or 125.64 divided by 2 = 62.82 feet.

We could also find the length of a quarter-wave antenna by cutting the numerator of the formula in half. Thus, the formula for the length of a quarter-wave antenna would be:

$L = \frac{234}{f}$ where: L is the antenna length in feet and f is the frequency in MHz.

If we use this formula, we will come up with the same answer as above:

$$L = \frac{234}{3.725} = 62.82 \text{ feet}$$

2I-2.2 What is the approximate length (in feet) of a quarter- wavelength vertical antenna for 7125 kHz?

A. 11 ft B. 16 ft C. 21 ft D. 33 ft

The answer is D. It would be one half of the answer to question 2I-1.2, or 65.68 feet divided by 2 = 32.84 feet. See answer 2I-2.1.

2I-2.3 What is the approximate length (in feet) of a quarter- wavelength vertical antenna for 21,125 kHz?

A. 7 ft B. 11 ft C. 14 ft D. 22 ft

The answer is B. It would be one half of the answer to question 2I-1.3, or 22.15 feet divided by 2 = 11.08 feet. See answer 2I-2.1.

2I-2.4 What is the approximate length (in feet) of a quarter- wavelength vertical antenna for 28,150 kHz?

A. 5 ft B. 8 ft C. 11 ft D. 17 ft

The answer is B. It would be one half of the answer to question 2I-1.4, or 16.63 feet divided by 2 = 8.32 feet. See answer 2I-2.1.

2I-2.5 When a vertical antenna is lengthened, what happens to its resonant frequency?

A. It decreases B. It increases
C. It stays the same D. It doubles

The answer is A. The resonant frequency of an antenna varies inversely with its length. Thus, as the antenna is lengthened, its resonant frequency is reduced. If the antenna length is reduced, its resonant frequency is increased.

2I-3.1 Why do many amateurs use a 5/8-wavelength vertical antenna rather than a 1/4-wavelength vertical antenna for their VHF or UHF mobile stations?

A. A 5/8-wavelength antenna can handle more power than a 1/4-wavelength antenna
B. A 5/8-wavelength antenna has more gain than a 1/4- wavelength antenna
C. A 5/8-wavelength antenna exhibits less corona loss than a 1/4-wavelength antenna
D. A 5/8-wavelength antenna looks more like a CB antenna, so it does not attract as much attention as a 1/4-wavelength antenna

The answer is B. A 5/8-wavelength vertical antenna has a power gain of 3 dB over a 1/4 wavelength vertical antenna.

2I-3.2 What type of radiation pattern is produced by a 5/8- wavelength vertical antenna?

A. A pattern with most of the transmitted signal concentrated in two opposite directions

B. A pattern with the transmitted signal going equally in all compass directions, with most of the radiation going high above the horizon
C. A pattern with the transmitted signal going equally in all compass directions, with most of the radiation going close to the horizon
D. A pattern with more of the transmitted signal concentrated in one direction than in other directions

The answer is C. A vertical antenna radiates equally well in all horizontal directions.

One question must be from the following:

2I-4-1.1 What type of antenna produces a radiation pattern with more of the transmitted signal concentrated in a particular direction than in other directions?
A. A dipole antenna
B. A vertical antenna
C. An isotropic antenna
D. A beam antenna

The answer is D. See answer 2I-4-1.2. A typical pattern of a beam antenna is shown in Figure 2I-4-1.1. In this particular pattern, maximum energy will be transmitted in the Northern direction.

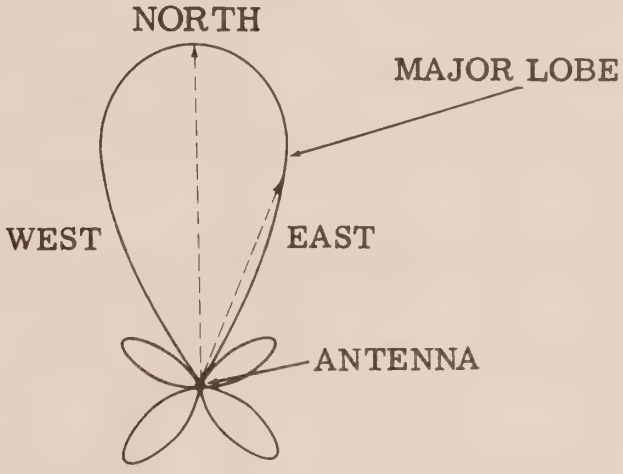


Figure 4I-4-1.1. Horizontal pattern of a beam antenna.

2I-4-1.2 What type of radiation pattern is produced by a Yagi antenna?
A. A pattern with the transmitted signal spread out equally in all compass directions
B. A pattern with more of the transmitted signal concentrated in one direction than in other directions
C. A pattern with most of the transmitted signal concentrated in two opposite directions
D. A pattern with most of the transmitted signal concentrated at high radiation angles

The answer is B. See question 2I-4-1.1. Figure 2I-4-1.1 shows the radiation pattern of a typical Yagi antenna. Note that the RF energy is concentrated in one direction.

A Yagi antenna consists of an ordinary half-wave dipole, plus one or more elements. Figure 2I-4 illustrates a simple three element Yagi antenna. The half-wave dipole element (B in Figure 2I-4), to which the transmission line is connected, is called the DRIVEN element. The driven element receives the transmitter output power from the transmission line. The other elements (A and C) are not physically connected to the transmission line or to the driven element. They are called "parasitic elements", and they receive their energy from the electromagnetic radiation of the driven element.

The addition of the parasitic elements increases the gain of the antenna considerably over that of a simple single element dipole. The additional antenna elements don't add RF energy to the antenna; they concentrate the radiated energy in one direction. The more the parasitic elements, the greater is the concentration or directivity of the antenna.

The transmitting advantages of a Yagi are also present in receiving. It will receive much better in the direction that it is "pointed", compared to a single element dipole. Also, it does not pick up well from other directions.

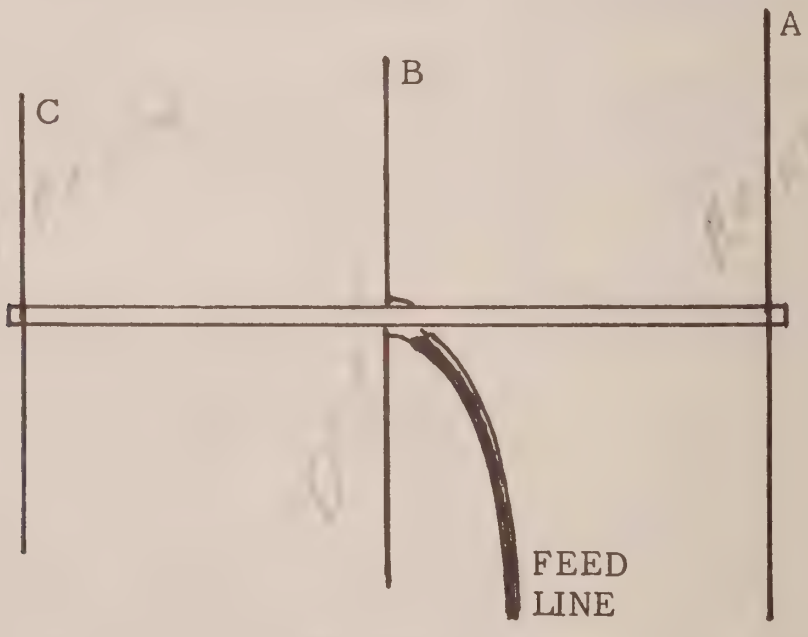


Figure 2I-4.

2I-4-1.3 Approximately how long (in wavelengths) is the driven element of a Yagi antenna?

A. 1/4 wavelength
B. 1/3 wavelength
C. 1/2 wavelength
D. 1 wavelength

The answer is C. The driven element, by itself, is a half-wave dipole.

2I-4-2.1 On the Yagi antenna shown in Figure 2I-4 (See Question 2I-4-1.2), what is the name of section B?

A. Director
B. Reflector
C. Boom
D. Driven element

The answer is D. See answer 2I-4-1.2.

2I-4-2.2 On the Yagi antenna shown in Figure 2I-4 (See Question 2I-4-1.2), what is the name of section C?

A. Director
B. Reflector
C. Boom
D. Driven element

The answer is A. The director is about 5% shorter than the driven element. The director is in the direction that most of the transmitted energy will travel.

2I-4-2.3 On the Yagi antenna shown in Figure 2I-4 (See Question 2I-4-1.2), what is the name of section A?

A. Director
B. Reflector
C. Boom
D. Driven element

The answer is B. The reflector is about 5% longer than the driven element.

2I-4-2.4 What are the names of the elements in a 3-element Yagi antenna?

A. Reflector, driven element and director
B. Boom, mast and reflector
C. Reflector, base and radiator
D. Driven element, trap and feed line

The answer is A. See answers 2I-4-1.2 through 2I-4-2.3.

2I-5.1 How should the antenna on a hand-held transceiver be positioned while you are transmitting?

A. Away from your head and away from others standing nearby
B. Pointed in the general direction of the repeater or other station you are transmitting to
C. Pointed in a general direction 90 degrees away from the repeater or other station you are transmitting to
D. With the top of the antenna angled down slightly to take the most advantage of ground reflections

The answer is A. See answer 2D-4.2.

2I-5.2 Why should you always locate your antennas so that no one can come in contact with them while you are transmitting?

A. Such contact can detune the antenna, causing television interference
B. To prevent RF burns and excessive exposure to RF energy
C. The antenna is more likely to radiate harmonics when it is touched
D. Such contact may reflect the transmitted signal back to the transmitter, damaging the final amplifier

The answer is B. See answer 2D-4.2.

2I-5.3 You are going to purchase a new antenna for your VHF or UHF hand-held radio. Which type of antenna is the best choice to produce a radiation pattern that will be least hazardous to your face and eyes?

A. A 1/8-wavelength whip
B. A 7/8-wavelength whip
C. A 1/2-wavelength whip
D. A short, helically wound, flexible antenna

The answer is C. The current and radiation are maximum at the bottom of the antenna in the 1/8 and 7/8 wavelength whip antennas. The current and radiation are maximum at the center of the 1/2 wavelength whip antenna. Thus, the maximum radiation is further away from the face when using a 1/2 wavelength whip than it is when using 1/8 and 7/8 wavelength whips.

One question must be from the following:

2I-6.1 What is a coaxial cable?

A. Two parallel conductors encased along the edges of a flat plastic ribbon
B. Two parallel conductors held at a fixed distance from each other by insulating rods
C. Two conductors twisted around each other in a double spiral
D. A center conductor encased in insulating material which is covered by a conducting sleeve or shield

The answer is D. Coaxial cable is a commonly used transmission line (feedline) that conducts RF energy from the transmitter to its antenna. It also conducts a signal from the antenna to its receiver. Coaxial cable consists of an inner conductor surrounded by a flexible insulator, which, in turn, is surrounded by a flexible wire braid. A weatherproof vinylite sheath surrounds the flexible wire braid. See Figure 2I-6.1. Typical characteristic impedances of coaxial cable are 52 and 75 ohms.

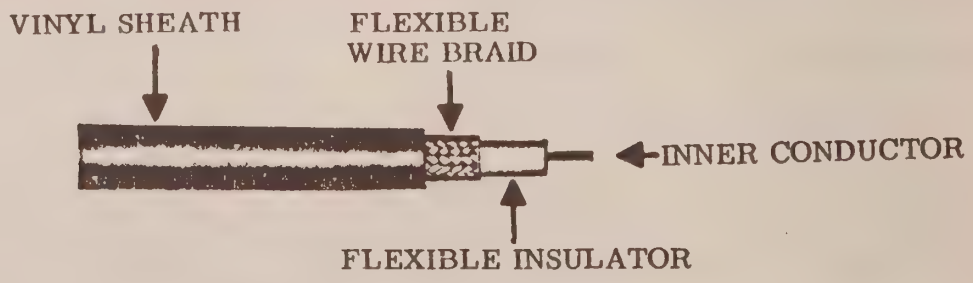


Fig. 2I-6.1 Coaxial Cable.

2I-6.2 What kind of antenna feed line is constructed of a center conductor encased in insulation which is then covered by an outer

conducting shield and weatherproof jacket?

A. Twin lead
B. Coaxial cable
C. Open-wire feed line
D. Wave guide

The answer is B. See the answer to question 2I-6.1.

2I-6.3 What are some advantages of using coaxial cable as an antenna feed line?

A. It is easy to make at home, and it has a characteristic impedance in the range of most common amateur antennas
B. It is weatherproof, and it has a characteristic impedance in the range of most common amateur antennas
C. It can be operated at a higher SWR than twin lead, and it is weatherproof
D. It is unaffected by nearby metallic objects, and has a characteristic impedance that is higher than twin lead

The answer is B. Other advantages of using coaxial cable are:

(1) The outer wire braid acts as a shield, preventing the radiation of harmonic and spurious signals.
(2) It is simple to install.
(3) It has minimum noise pickup.
(4) It is efficient.

2I-6.4 What commonly-available antenna feed line can be buried directly in the ground for some distance without adverse effects?

A. Twin lead
B. Coaxial cable
C. Parallel conductor
D. Twisted pair

The answer is B. Coaxial cable can be used because of its weatherproof vinyl covering.

2I-6.5 When an antenna feed line must be located near grounded metal objects, which commonly-available feed line should be used?

A. Twisted pair
B. Twin lead
C. Coaxial cable
D. Ladder-line

The answer is C. Coaxial cable should be used because its outer conductor acts as a shield.

2I-7.1 What is parallel-conductor feed line?

A. Two conductors twisted around each other in a double spiral
B. Two parallel conductors held a uniform distance apart by insulating material
C. A conductor encased in insulating material which is then covered by a conducting shield and a weatherproof jacket
D. A metallic pipe whose diameter is equal to or slightly greater than the

wavelength of the signal being carried

The answer is B. There are two types of parallel conductor feedline. One is called the "open wire" type, and the other is called the "twin-lead" type. Open-wire transmission line consists of two conductors in parallel, separated by insulating spacers. The twin-lead type consists of two parallel conductors, separated by flexible insulation. This type is commonly used in television installations. See Figure 2I-7.1.

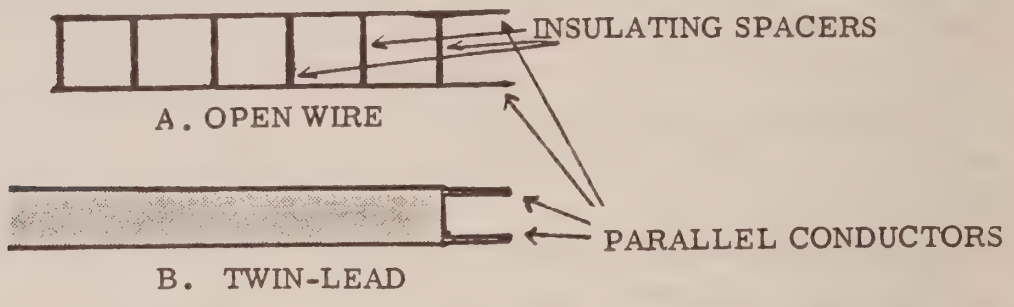


Fig. 2I-7.1 Parallel conductor transmission line.

2I-7.2 How can TV-type twin lead be used as a feed line?

A. By carefully running the feed line parallel to a metal post to ensure self resonance
B. TV-type twin lead cannot be used in an amateur station
C. By installing an impedance-matching network between the transmitter and feed line
D. By using a high-power amplifier and installing a power attenuator between the transmitter and feed line

The answer is C. TV-type twin lead can be used in the same manner as the better quality amateur parallel twin lead is used. However, the amateur must take into account the impedance of the TV-type twin lead. Most TV-type twin lead is 300 ohms; some of it is 75 ohms. He must make certain that the impedance of the transmitter, the twin lead and the antenna are properly matched. An impedance matching network may be necessary.

There are many brands of TV-type twin lead. An amateur should use a good quality standard brand so that the feedline losses are low. He should also check the current rating of the twin lead to make certain that it can handle the current that will be drawn by the antenna.

2I-7.3 What are some advantages of using parallel-conductor feed line?

A. It has a lower characteristic impedance than coaxial cable, and will operate at a higher SWR than coaxial cable
B. It will operate at a higher SWR than coaxial cable, and it is unaffected by nearby metal objects
C. It has a lower characteristic impedance than coaxial cable, and has less loss than coaxial cable

D. It will operate at higher SWR than coaxial cable and it has less loss than coaxial cable

The answer is D. Some other advantages are:

(1) It is a balanced line and is easier to match to a dipole antenna which is also balanced.

(2) The open wire type has a characteristic impedance of from 200 to 600 ohms, and can be used to match high impedance antennas.

(3) It has very low losses if it is properly constructed and properly used.

2I-7.4 What are some disadvantages of using parallel-conductor feed line?

A. It is affected by nearby metallic objects, and it has a characteristic impedance that is too high for direct connection to most amateur transmitters

B. It is more difficult to make at home than coaxial cable and it cannot be operated at a high SWR

C. It is affected by nearby metallic objects, and it cannot handle the power output of a typical amateur transmitter

D. It has a characteristic impedance that is too high for direct connection to most amateur transmitters, and it will operate at a high SWR

The answer is A. Some other disadvantages are:

(1) It is not shielded and can radiate or be affected by nearby metal objects.

(2) It may be difficult to install because the wires get tangled and touch each other.

(3) The twin lead type exhibits very high losses in wet weather.

2I-7.5 What kind of antenna feed line is constructed of two conductors maintained a uniform distance apart by insulated spreaders?

A. Coaxial cable

B. Ladder-line open conductor line

C. Twin lead in a plastic ribbon

D. Twisted pair

The answer is B. It is called "open-wire, parallel", or simply "openwire" transmission line.

2I-8.1 A certain antenna has a feed-point impedance of 35 ohms. You want to use a 50-ohm-impedance coaxial cable to feed this antenna. What type of device will you need to connect between the antenna and the feed line?

A. A balun

B. An SWR bridge

C. An impedance matching device

D. A low-pass filter

The answer is C. In order to transfer maximum RF power to the antenna, the impedance of the antenna at the feedpoint must be equal to the impedance of the transmission line. If they are not equal, an impedance matching device (usually a form of transformer) must be used.

2I-8.2 A certain antenna system has an impedance of 1000 ohms on one band. What must you use to connect this antenna system to the 50-ohm output on your transmitter?
A. A balun
B. An SWR bridge
C. An impedance matching device
D. A low-pass filter
The answer is C. See answer 2I-8.1.

2I-9.1 The word balun is a contraction for what phrase?
A. Balanced-antenna-lobe use network
B. Broadband-amplifier linearly unregulated
C. Balanced unmodulator
D. Balanced to unbalanced
The answer is D. We use the "bal" of "balanced" and the "un" of "unbalanced" to form the word BALUN. An example of a balun's use is when you feed a balanced antenna with an unbalanced transmission line.

2I-9.2 Where would you install a balun if you wanted to feed your dipole antenna with 450-ohm parallel-conductor feed line?
A. At the transmitter end of the feed line
B. At the antenna feed point
C. In only one conductor of the feed line
D. From one conductor of the feed line to ground
The answer is A. The balun is used to match the balanced parallel conductor feedline to the unbalanced output of the transmitter.

2I-9.3 Where might you install a balun if you wanted to feed your dipole antenna with 50-ohm coaxial cable?
A. You might install a balun at the antenna feed point
B. You might install a balun at the transmitter output
C. You might install a balun 1/2 wavelength from the transmitter
D. You might install baluns in the middle of each side of the dipole
The answer is A. The balun is used to match the balanced dipole antenna to the unbalanced coaxial feed line.

2I-10-1.1 A four-element Yagi antenna is mounted with its elements parallel to the ground. A signal produced by this antenna will have what type of polarization?

A. Broadside polarization
B. Circular polarization
C. Horizontal polarization
D. Vertical polarization

The answer is C. If the elements are parallel to the ground, the antenna is a horizontal antenna. A horizontal antenna produces a horizontally polarized wave.

2I-11-1.1 A four-element Yagi antenna is mounted with its elements perpendicular to the ground. A signal produced by this antenna will have what type of polarization?

A. Broadside polarization
B. Circular polarization
C. Horizontal polarization
D. Vertical polarization

The answer is D. If the elements are perpendicular to the ground, the antenna is a vertical antenna. A vertical antenna produces a vertically polarized wave.

ANSWERS TO SAMPLE NOVICE EXAMINATION

1. D	6. C	11. D	16. C	21. B	26. B
2. C	7. C	12. B	17. B	22. C	27. A
3. C	8. B	13. D	18. D	23. A	28. A
4. D	9. A	14. B	19. D	24. B	29. C
5. D	10. C	15. D	20. C	25. C	30. C

SAMPLE NOVICE EXAMINATION

The following sample examination provides an added means of preparation for the actual test and serves as a gauge of preparedness. Answers are on page I-12.

1. What term describes a person holding a written authorization to be the control operator of an amateur station?
A. A Citizen Radio operator
B. A Personal Radio operator
C. A Radio Service operator
D. An amateur operator

2. What is the portion of an amateur operator/primary station license that conveys operator privileges?
A. The verification section
B. Form 610
C. The operator license
D. The station license

3. What frequencies are available in the amateur 40-meter wavelength band for a control operator holding a Novice class operator license in ITU region 2?
A. 3500 to 4000 kHz
B. 3700 to 3750 kHz
C. 7100 to 7150 kHz
D. 7000 to 7300 kHz

4. Which one of the following call signs is a valid US amateur call?
A. CE2FTF
B. G3GVA
C. UA1ZAM
D. AA2Z

5. On what frequencies in the 10 meter wavelength band may a Novice control operator use single-sideband phone?
A. 3700 to 3750 kHz
B. 7100 to 7150 kHz
C. 21100 to 21200 kHz
D. 28300 to 28500 kHz

6. What is the maximum transmitting power permitted an amateur station transmitting on 3725 kHz?
A. 75 watts PEP output
B. 100 watts PEP output
C. 200 watts PEP output
D. 1500 watts PEP output

7. Who is held responsible for the proper operation of an amateur station?
A. Only the control operator
B. Only the station licensee
C. Both the control operator and the station licensee
D. The person who owns the property where the station is located

8. What is the longest period of time during a QSO that an amateur station does not need to transmit its station identification?
A. 5 minutes
B. 10 minutes
C. 15 minutes
D. 20 minutes

9. Is an amateur station permitted to transmit music?
A. The transmission of music is not permitted in the amateur service
B. When the music played produces no dissonances or spurious emissions
C. When it is used to jam an illegal transmission
D. Only above 1280 MHz

10. As an Amateur Radio operator, you receive an Official Notice of Violation from the FCC. How promptly must you respond?
A. Within 90 days
B. Within 30 days
C. As specified in the Notice
D. The next day

11. What is the meaning of the Morse code character SK?

A. Received some correctly
B. Best regards
C. Wait
D. End of contact

12. You receive an RTTY CQ call at 45 bauds. At what speed should you respond?
A. 22-1/2 bauds B. 45 bauds C. 90 bauds
D. Any speed, since radioteletype systems adjust to any signal rate

13. What type of propagation involves radio signals that travel along the surface of the Earth?
A. Sky-wave propagation
B. Knife-edge diffraction
C. E-layer propagation
D. Ground-wave propagation

14. For proper protection from lightning strikes, what equipment should be grounded in an amateur station?
A. The power supply primary
B. All station equipment
C. The feed line center conductors
D. The ac power mains

15. What type of safety equipment should you wear when you are working at the top of an antenna tower?
A. A grounding chain
B. A reflective vest
C. Loose clothing
D. A carefully inspected safety belt

16. What accessory is used to measure standing wave ratio?
A. An ohm meter
B. An ammeter
C. An SWR meter
D. A current bridge

17. What type of filter should be installed on a TV receiver as the first step in preventing RF overload from an amateur HF station transmission?
A. Low pass B. High pass C. Band pass D. Notch

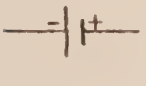
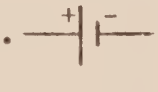
18. Your receiver dial is calibrated in gigahertz and shows a signal at 1.2 GHz. At what frequency would a dial calibrated in megahertz show the same signal?
A. 1.2 MHz B. 12 MHz C. 120 MHz D. 1200 MHz

19. The pressure in a water pipe is comparable to what force in an electrical circuit?
A. Current B. Resistance C. Gravitation D. Voltage

20. There is a 3-amp current through a resistor and we know that the applied voltage is 90 volts. What is the value of the resistor?
A. 0.03 ohms B. 10 ohms C. 30 ohms D. 2700 ohms

21. What is the term used to describe a current that flows only in one direction?
A. Alternating current
B. Direct current
C. Periodic current
D. Pulsating current

22. What is the symbol used on schematic diagrams to represent a single-cell battery?

A. 
B.
C. 
D.

23. What is the symbol used to represent a PNP bipolar transistor on schematic diagrams?

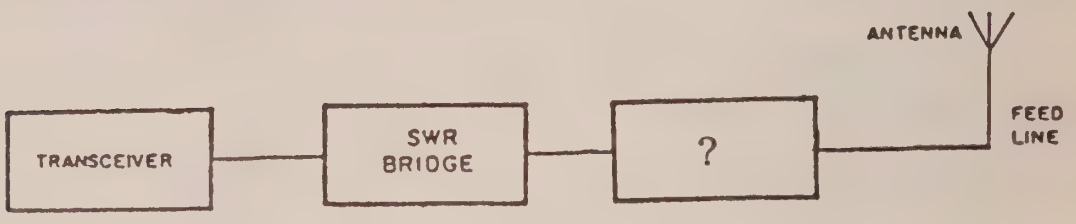
A.

B.

C.

D.

24. What is the unlabeled block (?) in this diagram?



A. An antenna switch
B. An impedance-matching network
C. A key click filter
D. A terminal-node controller

25. What station accessory do many amateurs use to help form good Morse code characters?
A. A sidetone oscillator
B. A key-click filter
C. An electronic keyer
D. A DTMF keypad

26. What type of problem can a bad power-supply filter capacitor cause in a transmitter or receiver?
A. Sympathetic vibrations in nearby receivers
B. A superimposed hum or buzzing sound
C. Extreme changes in antenna resonance
D. Imbalance in the mixers

27. What is the 4th harmonic of a 7160-kHz signal?
A. 28,640 kHz B. 35,800 kHz C. 28,160 kHz D. 1790 kHz

28. What is the approximate length (in feet) of a half- wavelength dipole antenna for 3725 kHz?
A. 126 ft B. 81 ft C. 63 ft D. 40 ft

29. Approximately how long (in wavelengths) is the driven element of a Yagi antenna?
A. 1/4 wavelength B. 1/3 wavelength C. 1/2 wavelength D. 1 wavelength

30. When an antenna feed line must be located near grounded metal objects, which commonly-available feed line should be used?
A. Twisted pair B. Twin lead C. Coaxial cable D. Ladder-line

APPENDIX 1
TABLE OF EMISSIONS

Since 1979, the electronics industry has been using the WARC emission symbols. In this system, the old 2-character symbols have been replaced with 3-character symbols. The 3-character symbols give more specific information concerning the emissions that they represent. See Appendix 2 on page AP-2.

FIRST CHARACTER

- N Emission of an unmodulated carrier
- A AM double-sideband
- J Single sideband, suppressed carrier
- F Frequency modulation
- G Phase modulation
- P Sequence of unmodulated pulses
- C Vestigial sidebands
- H Single sideband full carrier
- R Single sideband reduced carrier
- K Sequence of pulses, amplitude modulated
- L Sequence of pulses, modulated in width/duration
- M Sequence of pulses, modulated in position/phase

SECOND CHARACTER

- 0 No modulating symbol
- 1 Digital information-no modulation
- 2 Digital information with modulation
- 3 Modulated with analog information
- 7 2 or more channels with digital info
- 8 2 or more channels with analog info
- 9 combination analog and digital info
- X cases not otherwise covered

THIRD CHARACTER

- N No information transmitted
- A Telegraphy for aural reception
- B Telegraphy for automatic reception
- C Facsimile
- D Data transmission, telemetry, telecommand
- E Telephony
- F Television
- W Combination of the above
- X Cases not otherwise covered

	Traditional Symbol	New Symbol
AMPLITUDE MODULATED		
Unmodulated	A0	N0N
Keyed on/off	A1	A1A
Tones keyed on/off	A2	A2A
AM data		A2D
Keyed tones w/SSB	A2J	J2A
SSB data		J2D
AM voice	A3	A3E
Voice w/SSB	A3J	J3E
AM facsimile	A4	A3C
SSB television	A5	C3F
AM television	A5	A3F
FREQUENCY MODULATED		
Unmodulated	F0	N0N
Switched between two frequencies	F1	F1B
Switched tones	F2	F2A
FM data		F2D
FM voice	F3	F3E
FM facsimile	F4	F3C
FM television	F5	F3F
PULSE MODULATED		
Phase	P	P1B

APPENDIX 2
FCC EMISSION DEFINITIONS

The emission designators, given in Appendix 1, were considered, by the FCC, to be too complex. In the reorganization of the Part 97 Rules and Regulations, effective September 1, 1989, the emission designators were grouped into a simple system based on nine terms that are already familiar to amateur operators. This makes it possible for amateur operators to understand immediately their authorized emissions. These nine terms are defined below.

(1) **CW**. International Morse code telegraphy emissions having designators with A, C, H, J or R as the first symbol; 1 as the second symbol; A or B as the third symbol; and emissions J2A and J2B.
(2) **DATA**. Telemetry, telecommand and computer communications emissions having designators with A, C, D, F, G, H or R as the first symbol; 1 as the second symbol; D as the third symbol; and emission J2D. Only a digital code of a type specifically authorized in this part may be transmitted.
(3) **IMAGE**. Facsimile and television emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1, 2 or 3 as the second symbol; C or F as the third symbol; and emissions having B as the first symbol; 7, 8 or 9 as the second symbol; W as the third symbol.
(4) **MCW**. Tone modulated international Morse code telegraphy emissions having designators with A, C, D, F, G, H or R as the first symbol; 2 as the second symbol; A or B as the third symbol.
(5) **PHONE**. Speech and other sound emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1, 2 or 3 as the second symbol; E as the third symbol. Also speech emissions having B as the first symbol; 7, 8 or 9 as the second symbol; E as the third symbol. MCW for the purpose of performing the station identification procedure, or for providing telegraphy practice interspersed with speech. Incidental tones for the purpose of selective calling or alerting or to control the level of a demodulated signal may also be considered phone.
(6) **PULSE**. Emissions having designators with K, L, M, P, Q, V or W as the first symbol; 0, 1, 2, 3, 7, 8, 9 or X as the second symbol; A, B, C, D, E, F, N, W or X as the third symbol.
(7) **RTTY**. Narrow-band direct-printing telegraphy emissions having designators with A, C, D, F, G, H, J or R as the first symbol; 1 as the second symbol; B as the third symbol; and emission J2B. Only a digital code of a type specifically authorized in this Part may be transmitted.
(8) **SS**. Spread-spectrum emissions using bandwidth-expansion modulation emissions having designators with A, C, D, F, G, H, J or R as the first symbol; X as the second symbol; X as the third symbol. Only a SS emission of a type specifically authorized in this Part may be transmitted.
(9) **TEST**. Emissions containing no information having the designators with N as the third symbol. "Test" does not include pulse emissions with no information or modulation unless pulse emissions are also authorized in the frequency band.

APPENDIX 3
RST Reporting System

The RST Reporting System is a means of rating the quality of a signal on a numerical basis. In this system, the R stands for readabilty, and is rated on a scale of 1 to 5. The S stands for signal strength, and it is rated on a scale of 1 to 9. The T indicates the quality of a CW tone, and its scale is also 1 to 9. The higher the number, the better the signal.

READABILITY

1. Unreadable
2. Barely readable; occasional words distinguishable
3. Readable with considerable difficulty
4. Readable with practically no difficulty
5. Perfectly readable

SIGNAL STRENGTH

1. Faint; signals barely perceptible
2. Very weak signals
3. Weak signals
4. Fair signals
5. Fairly good signals
6. Good signals
7. Moderately strong signals
8. Strong signals
9. Extremely strong signals

TONE

1. Extremely rough, hissing tone
2. Very rough AC note; no trace of musicality
3. Rough, low-pitched AC note; slightly musical
4. Rather rough AC note; moderately musical
5. Musically modulated
6. Modulated note; slight trace of whistle
7. Near DC note; smooth ripple
8. Good DC note; just a trace of ripple
9. Purest DC note (If note appears to be crystal controlled, add letter X after the number indicating tone)

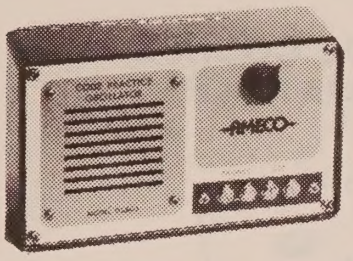
EXAMPLE: Your signals are RST 599X. (Your signals are perfectly readable, extremely strong, have purest DC note, and sound as if your transmitter is crystal-controlled.)

125 222.1-223.91

FREQUENCY ALLOCATIONS FOR POPULAR AMATEUR BANDS All in MegaHertz. "X" indicates no privileges.										
CLASSES	NOVICE		TECHNICIAN		GENERAL AND CONDITIONAL		ADVANCED		EXTRA	
BANDS	CW	PHONE	CW	PHONE	CW	PHONE	CW	PHONE	CW	PHONE
80 METERS	3.7 to 3.75	X	3.7 to 3.75	X	3.525 to 3.750 and 3.85 to 4.0	3.85 to 4.0	3.525 to 3.750 and 3.775 to 4.0	3.775 to 4.0	3.5 to 4.0	3.75 to 4.0
40 METERS	7.1 to 7.15	X	7.1 to 7.15	X	7.025 to 7.150 and 7.225 to 7.3	7.225 to 7.3	7.025 to 7.3	7.15 to 7.3	7.0 to 7.3	7.15 to 7.3
20 METERS	X	X	X	X	14.025 to 14.15 and 14.225 to 14.35	14.225 to 14.35	14.025 to 14.15 and 14.175 to 14.35	14.175 to 14.35	14.0 to 14.35	14.15 to 14.35
15 METERS	21.1 to 21.2	X	21.1 to 21.2	X	21.025 to 21.20 and 21.30 to 21.450	21.3 to 21.450	21.025 to 21.20 and 21.225 to 21.45	21.225 to 21.450	21.0 to 21.450	21.2 to 21.45
10 METERS	28.1 to 28.5	28.3 to 28.5	28.1 to 28.5	28.3 to 28.5	28.0 to 29.7	28.3 to 29.7	28.0 to 29.7	28.3 to 29.7	28.0 to 29.7	28.3 to 29.7
6 METERS	X	X	50.0 to 54.0	50.1 to 54.0	50.0 to 54.0	50.1 to 54.0	50.0 to 54.0	50.1 to 54.0	50.0 to 54.0	50.1 to 54.0
2 METERS	X	X	144.0 to 148.0	144.1 to 148.0	144.0 to 148.0	144.1 to 148.0	144.0 to 148.0	144.1 to 148.0	144.0 to 148.0	144.1 to 148.0

1.20 ALL 220

CODE PRACTICE OSCILLATOR & MONITOR IN KIT FORM OR WIRED

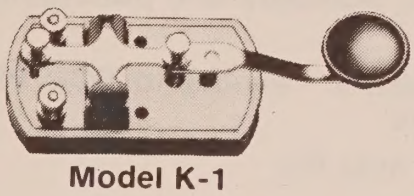


MODEL OCM-2 is a solid-state code practice oscillator and monitor that uses the latest IC circuitry. It contains a 3" built-in speaker, headphone terminals, a volume control and a tone control. It is attractively packaged with a two color panel.

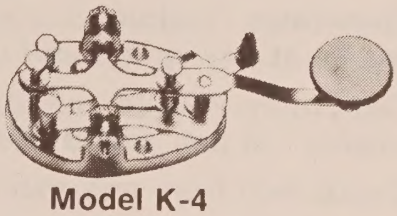
With the addition of a few parts, the unit can easily be converted into a CW monitor. It can therefore be used as an operating aid after the code has been learned.

Cat. #OCM-2K - Code Oscillator & Monitor - Kit $18.95
Cat. #OCM-2W - Code Oscillator & Monitor - Wired $24.95

TELEGRAPH KEYS



Model K-1

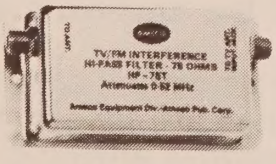


Model K-4

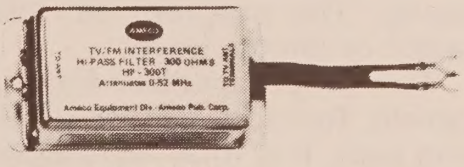
Model K-1 is a low cost, general purpose key with a molded phenolic base and 1/8" contacts. The spring tension and contact spacing are easily adjusted. – $4.95

Model K-4 is a high quality key with a polished brass base, a shorting bar, and 1/8" silver contacts. The contact spacing and tension are easily adjusted. Smooth keying is assured by adjustable ball bearings. – $9.95

STOP TV, FM & VCR INTERFERENCE WITH AMECO HIGH-PASS FILTERS



HP-75T



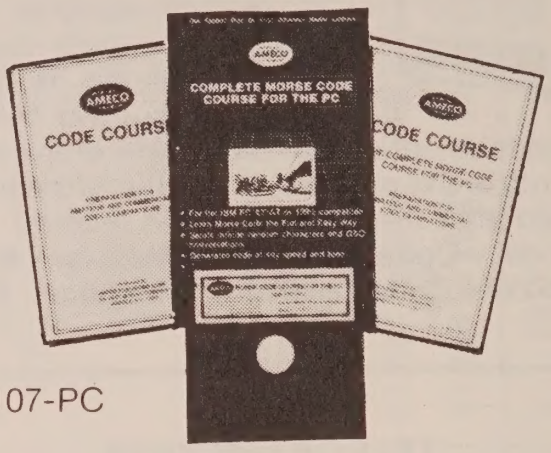
HP-300T

Eliminate interference from Ham, CB, short-wave, medical equipment, etc. Each filter has 9 shielded sections, a sharp cut-off at 52 MHz. and over 70 dB attenuation below 50 MHz.

Cat. #HP-75T is for coax. feedline and is ideal for the new cable systems. Included are all connectors and a length of coax. – $12.95

Cat. #HP-300T is for twin-lead installations and includes all connectors, terminals and twin-lead with lugs. – $12.95

COMPLETE MORSE CODE COURSE FOR IBM PC AND COMPATIBLES



Cat. #107-PC

- **Generates random characters, numbers and punctuation marks at any speed and tone**
- **Generates infinite random QSO's - similar to FCC/VEC exams - at any speed and tone**
- **Sends text from any external data file**
- **Includes 32 page book on code learning and user's manual**
- **Learn Morse Code the fun and easy way**
- **Plus many, many more features**

This is the most versatile code course ever developed. It has more features and code training capability than all other code courses on the market combined! It is user friendly, menu driven, and contains over 18 options. It will run on any IBM PC/XT/AT or 100% compatible - at any clock speed, in either monochrome or color.

There are many other features, including quiz sessions for the beginner and the ability to alter letter, character and word spacing. The program can also turn the keyboard into a straight or iambic keyer.

This program allows for an infinite amount of code to be received. Random material and combinations are constantly being sent. It is thus impossible to memorize anything.

This course is ideal for the beginner, and perfect for the licensed ham who wishes to upgrade! And it comes from Ameco, the oldest and largest publisher of code training material. Cat. #107-PC - $19.95

OTHER BOOKS AND COURSES PUBLISHED BY THE AMECO PUBLISHING CORP.

RADIO AMATEUR FCC TEST MANUALS. Contains all the latest, official FCC/VEC test questions and multiple choice answers, plus answers and easy-to-understand discussions to each question. Excellent preparation for all amateur exams.

Cat. #27-01 - NOVICE CLASS license. $5.95
Cat. #28-01 - TECHNICIAN CLASS license. $5.95
Cat. #12-01 - GENERAL CLASS license $5.95
Cat. #26-01 - ADVANCED CLASS license. $4.95
Cat. #17-01 - EXTRA CLASS license. $5.95

AMATEUR RADIO NOVICE CLASS EXAM. Contains a complete 30 question sealed Novice exam with instructions, sealed answers, and Form 610 for the volunteer examiners. Includes complete instructions for the applicant. Cat. #EN-1 . . . . . $1.50

AMATEUR RADIO THEORY COURSE. Complete, simplified course covering the requirements for Novice, Technician, and General Classes of licenses. Contains 15 lessons, 3 study guides and over 400 FCC-type Multiple Choice questions. No technical background required. 330 pages.
Cat. #102-01 . . . . . $6.95

AMATEUR RADIO NOVICE CLASS THEORY COURSE. Same as above, except that it contains only the information for the Novice Class license. Over 200 FCC-type multiple choice questions. 128 pages.
Cat. #23-01. . . . . $5.95

COMMERCIAL RADIO OPERATOR THEORY COURSE. Complete, simplified course for General Radiotelephone Operator License. Contains 21 lessons and over 600 FCC-type multiple choice questions. No technical background required. 448 pages. Cat. #15-01 . . . . . $8.95

COMMERCIAL RADIO OPERATOR'S QUESTION AND ANSWER LICENSE GUIDE for the General Radiotelephone License. Contains questions, answers and sample FCC-type examination. 160 pages.
Cat. #9-01 . . . . . $5.95

MARINE RADIO OPERATOR LICENSE GUIDE. Contains FCC questions and answers for new Marine Radio Operator Permit. Also includes FCC-type exams and basic electronic theory. 64 pages.
Cat. #8-01 . . . . . $3.95

TRANSISTOR THEORY AND CIRCUITS MADE SIMPLE. Transistor theory is explained in a simple manner. Explains how transistors operate in amplifiers, oscillators, etc. Many practical circuits using transistors are given. 128 pages. Cat.#11-01. . . . . $3.50

DIGITAL COMPUTERS MADE SIMPLE. A basic book, written for the layman with little technical background. Starts with simple number systems and covers all phases of digital computers. 128 pages. Cat. #18-01. . . . . $2.50

NOVICE CODE COURSE. Prepares for Novice and Technician exams. Contains 10 lessons, code speed from start to 8 WPM. Course includes typical FCC-type code exams, instruction book on how to receive code the simplest, fastest way, with charts to check receiving accuracy, etc.
Cat. #100-33 (1 LP, 33 RPM) . . . . . $3.95 Cat. #100-T (1 cassette tape). $4.95

SENIOR CODE COURSE. Contains everything given in Novice Code Course, plus 12 additional lessons to bring speed up to 18 WPM. Prepares for General license with extra WPM to spare.
Cat. #101-33 (2 LP's, 33 RPM). . . . . $7.50 Cat. #101-T (2 cassette tapes). $8.95

ADVANCED CODE COURSE. Prepares for the General Class license. Contains the last 12 lessons of the Senior Course, plus FCC-type code exams. 8-1/2 to 18 WPM
Cat. #103-33 (1 LP, 33 RPM). . . . . $3.95 Cat. #103-T (1 cassette tape). $4.95

EXTRA CLASS CODE COURSE. Increases code speed from 13 to 22 WPM. Includes sample FCC-type code examination for Extra Class license.
Cat. #104-33 (1 LP, 33 RPM). . . . . $3.95 Cat. #104-T (1 cassette tape). $4.95

GENERAL CLASS SUPPLEMENTARY CODE COURSE. Concentrated code practice between 12 and 15 WPM. Provides additional code practice material for the General Class code examination.
Cat. #105-33 (1 LP, 33 RPM) $3.95
Cat. #105-QT. QSO material similar to FCC code tests. (1 cassette tape). $4.95

EXTRA CLASS SUPPLEMENTARY CODE COURSE. Concentrated code practice between 19 and 24 WPM. Provides additional code practice material for the Extra Class code examination.
Cat. #106-33 (1 LP, 33 RPM). $3.95
Cat. #106-QT. QSO material similar to FCC code tests. (1 cassette tape). $4.95

"COMMUNICATE WITH THE WORLD THROUGH HAM RADIO". Combination package consists of the Novice Code Course (Cat. #100-T) and the Amateur Radio Novice Class Theory Course (Cat #23-01). Complete package for the prospective Novice. Cat. #NP-1 . . . . . $9.95

AMECO'S COMPLETE MORSE CODE COURSE FOR THE PC. The most versatile program designed for the IBM PC/XT/AT or compatible. User friendly, with over 18 menu options. Random characters, random QSO's, send external files, quiz sessions, all at any speed and tone. Includes Code learning book. Plus many, many more features. Cat. #107-PC . Specify 5-1/4" or 3-1/2" disk . $19.95